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RECORD OF DECISION

COMMENCEMENT BAY NEARSHORE/ TIDEFLATS SUPERFUND SITE OPERABLE UNIT 04 RUSTON/NORTH TACOMA STUDY AREA RUSTON AND TACOMA, WASHINGTON

June 1993

EPA Region 10

AR 3.1

DECLARATION FOR THE RECORD OF DECISION

Site Name and Location

Commencement Bay Nearshore/Tideflats Superfund Site
Operable Unit 04 -- Ruston/North Tacoma Study Area
Ruston and Tacoma, Washington

Statement of Basis and Purpose

This decision document presents the selected remedial action for the Ruston/North Tacoma Study Area, in Ruston and Tacoma, Washington, which was chosen in accordance with CERCLA, as amended by SARA, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for this site. The State of Washington concurs with the selected remedy.

Assessment of the Site

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent or substantial endangerment to public health, welfare, or the environment.

Description of the Selected Remedy

The EPA has divided the Commencement Bay/Nearshore Tideflats Superfund site into seven operable units (OU's) in order to facilitate the investigation, analysis, and cleanup of this very large site. Four of these OU's are associated with the Asarco smelter:

- OU 02 Asarco Tacoma Smelter
- OU 04 Asarco Off-Property (Ruston/North Tacoma Study Area)
- OU 06 Asarco Sediments
- OU 07 Asarco Demolition

The remedy described in this ROD addresses OU 04 and involves the cleanup of arsenic and lead contaminated soils and slag in the Study Area, the residential community surrounding the smelter. This remedy will address the principal threat posed by conditions at the site, which is the ingestion of contaminated soil and dust, and includes:

- Designation of "action levels" or concentrations of arsenic or lead in soil. Engineering measures will address properties or areas that exceed action levels.

- Sampling of individual properties to determine if soil exceeds the action levels.

- Excavation and off-site disposal of contaminated soil and slag from properties that exceed action levels. Contaminated soil below 18 inches will not be excavated but will be capped.

- Excavation of slag from all other properties.

- Replacement of excavated soil and slag with clean soil and gravel.

- Asphalt capping or soil removal and replacement with gravel of contaminated dirt alleys and parking areas.

- Fencing and planting low lying shrubs in steep areas.

- Soil collection program for soil above action levels that is not excavated during the cleanup (e.g., soil below 18 inches that is uncovered in the future).

- The development and implementation of community protection measures (CPMs). CPMs are administrative requirements that will address soil that is not excavated but that contains concentrations of arsenic or lead that exceed either action levels or levels commonly found in urban areas.

Statutory Determinations

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies, to the maximum extent practicable for this site. However, because treatment of the principal threats of the site was not found to be practicable, this remedy does not satisfy the statutory preference for treatment as a principal element.

Because the remedy may result in hazardous substances remaining on-site above health-based levels, a review will be conducted no less often than every five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Gerald A. Emison
Acting Regional Administrator
U.S. EPA Region 10

6-16-93
Date

RECORD OF DECISION

COMMENCEMENT BAY NEARSHORE/ TIDEFLATS SUPERFUND SITE OPERABLE UNIT 04 RUSTON/NORTH TACOMA STUDY AREA RUSTON AND TACOMA, WASHINGTON

June 1993

EPA Region 10

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RUSTON AND TACOMA, WASHINGTON

1.0 SITE DESCRIPTION

The Ruston/North Tacoma Study Area (Study Area) is an operable unit of the Commencement Bay Nearshore/Tideflats (CB N/T) Superfund site. The CB N/T Superfund site was listed on the interim priority list by the U.S. Environmental Protection Agency (EPA) in 1981, and included in the first published National Priorities List in September 1983. The Study Area, approximately 950 acres, comprises an arc of approximately one mile radius surrounding the Asarco Tacoma smelter (Asarco smelter) and consists of the Town of Ruston and a northern portion of the City of Tacoma, Washington (Figure 1). The EPA and the Washington State Department of Ecology (Ecology) identified the Study Area as the primary focus for conducting a Remedial Investigation/Feasibility Study (RI/FS) (see Section 2.0 for a discussion of how the Study Area was defined). This Record of Decision (ROD) addresses contaminated soils and slag within the residential Study Area surrounding the Asarco smelter.

The smelter began operations in 1890 as a lead smelter. Asarco purchased the smelter in 1905 and converted it to a copper smelter in 1912. The smelter specialized in processing ores with high arsenic concentrations and recovered arsenic trioxide and metallic arsenic as by-products. In recovering copper from ores and concentrates, the smelting process also produced slag, a hard, glassy material containing elevated concentrations of arsenic, lead, and other metals. Copper smelting operations ceased in 1985, and the arsenic production plant was closed in 1986. The Asarco smelter facility, including demolition of structures on the smelter property, and sediments adjacent to the smelter property are being addressed as separate operable units of the CB N/T Superfund site (see Section 4.0).

The Study Area land use is primarily residential and includes schools, playgrounds, and parks. The Study Area includes a population of approximately 4,290, and about 1,820 housing units. Commercial development consisting of retail shops and small businesses is limited in extent and mainly confined to an area along Pearl Street. The Asarco smelter, which ceased operations in 1985, is located to the northeast of the Study Area and was the principal industrial facility in the area. The southern portion of Point Defiance Park and Zoo, which extends along a wooded peninsula to the northwest of the smelter, is located within the Study Area and includes access to the Vashon Island Ferry. Properties to the southeast of the Study Area, which were previously industrial in nature, are actively being redeveloped with restaurants, a fishing pier, park areas, and other public uses.

The Study Area is characterized by a rolling topography. Elevations, according to United States Geological Survey documents, range from 10 feet (3 meters) above Mean Sea Level (MSL) to 250 feet (75 meters) MSL, with elevations decreasing at a fairly uniform rate towards the northeast (Commencement Bay). High bluffs form the shoreline boundary of the Study Area separating it from Commencement Bay and the Asarco smelter facility. Steep ravines occur in the vicinity of rail tracks that cross the site in an east-west direction. There are areas of dense vegetation, such as steep slopes of ravines (particularly southwest and west of the Asarco property) and along the slope toward Commencement Bay above Ruston Way. In general, however, construction of residences has resulted in clearing most of the area with the exception of scattered trees and landscaping.

Few surface water features exist within the Study Area. Some springs emerge from shallow ground water zones along the face of the shoreline bluffs. A field investigation of ground water conditions was not included as part of the RI. Based on the impermeable characteristics of the till and silts, the presumed depth to ground water, and the characteristics of the contaminants, it is not considered likely that contamination from Asarco smelter airborne emissions has migrated to the ground water or substantially affected ground water quality. Ground water in the Study Area is not currently used as a source for drinking water.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Operation of the Asarco smelter for over 95 years resulted in contamination of various environmental media in the surrounding area. That contamination was the result of airborne emissions from smelting operations. Early soil sampling studies as well as deposition modeling were useful in suggesting the overall pattern of soil contamination with distance and direction from the smelter. The Exposure Pathway Study (discussed further below) conducted by the University of Washington included additional sampling locations, and provided information on soil contamination at the time of the smelter closure in 1985-1986.

In 1988 a Field Investigation Report (FIR) was developed for the Washington State Department of Ecology. Based on a review of all available soil sampling results, sampling for the FIR was designed to characterize soil contamination patterns in an area out to about 100 parts per million (ppm) arsenic, which was interpreted to be at a distance of about 3/4 to 1 mile from the smelter.

The EPA RI/FS work plans were developed in 1989. The sampling focused on the same Study Area as the FIR, and was designed to address data gaps, areas of uncertainty, and develop additional spatial data.

Subsequent to all of these soil sampling studies, the Cleanup Standards under the Model Toxics Control Act (MTCA) were adopted by Ecology (February 1991). The cleanup standard for soil arsenic in residential areas as defined in the regulation would result in a larger area for characterizing the extent of soil contamination by arsenic (to an area defined by 20 ppm rather than by 100 ppm). This ROD, however, addresses contaminated soils and slag within the more limited Study Area surrounding the former smelter site as defined for the RI study (see also Section 4.1).

Asarco is liable under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or the Superfund law) for the cost of cleanup of hazardous substances that were released from the smelter. EPA first notified Asarco of its potential liability for the contamination of the area surrounding the smelter in July 1984. EPA had previously notified Asarco of its potential liability for the contamination of Commencement Bay in March 1982.

2.1 Cleanup Activities in Areas Surrounding the Smelter Site

The residential area adjacent to the smelter has been the subject of many investigations over the past 20 years (see summary of reports on pages 1-8 through 1-13 of the Remedial Investigation (RI) Report for Ruston/North Tacoma, Washington, Bechtel, January 1992). Several recent studies, mentioned above, are described in the following text. These studies are significant in that they formed the basis for a 1989 EPA decision to conduct an Expedited Response Action (ERA) at several publicly accessible properties in the Study Area.

Exposure Pathways Study

Initiated in 1985 and released in 1987, the Exposure Pathways Study (Ruston/Vashon Arsenic Exposure Pathways Study, University of Washington, 1987) investigated the pathways contributing arsenic to the bodies of residents in Tacoma and Vashon/Maury Islands. One of the objectives of this study was to determine what environmental media required remediation to effectively reduce the body burden of arsenic in the affected population. The study involved the repeated sampling of urine and a number of environmental media for arsenic analyses. It was performed just at the time when smelter operations ceased.

In the Exposure Pathways Study, an individual's age was shown to be significant for determining urinary arsenic levels, with young children most affected. Among other findings, the arsenic concentrations on children's hands were significantly associated with urinary arsenic concentrations, and with time spent in contact with soil and house dust. Ingestion of contaminated soil was identified as the primary route of exposure to arsenic.

Field Investigation Report

In 1988, a detailed investigation (Field Investigation Report [FIR], Ruston/Vashon Island Area, Black & Veatch, 1988) of post-shutdown soil contamination in the Study Area was performed by Ecology. Approximately 288 soil samples were collected from residential and non-residential high-use areas (parks, playgrounds, and vacant lots) within approximately 1 mile of the smelter. The FIR included an evaluation to determine if soil contamination was related to smelter emissions.

Endangerment Assessment and Engineering Evaluation/Cost Analysis

In conjunction with the FIR, an Endangerment Assessment (EA) (Endangerment Assessment Ruston/Vashon Island Area, Black & Veatch, 1988) and Engineering Evaluation/Cost Analysis (EE/CA) (Engineering Evaluation/Cost Analysis of Removal Action Alternatives: Ruston/Vashon Island Area, Black & Veatch, 1988) were also performed by Ecology. The EA evaluated the potential health effects from exposure to smelter-related contamination in soil, house dust, and air. The EE/CA was developed to evaluate removal action alternatives.

Urinary Arsenic Survey

As a follow-up to the Exposure Pathways Study, an additional urinary arsenic survey (Urinary Arsenic Survey, North Tacoma, Washington, Tacoma-Pierce County Health Department, 1988) was performed by the Tacoma-Pierce County Health Department (TPCHD) of children ages 2 - 8 years living within approximately 1/2 mile of the smelter. The results indicated that urinary arsenic levels had generally declined since smelter closure. Some individuals, however, still had elevated levels.

Expedited Response Action

Of the 20 nonresidential high-use areas identified and sampled as part of the FIR, 11 were determined to have arsenic concentrations resulting in estimated risks outside of EPA's range of acceptable risks for carcinogens. In March 1989, EPA and Asarco signed an Administrative Order on Consent for the performance of an ERA. Under the ERA, Asarco agreed to remove three inches of arsenic-contaminated soil at the 11 nonresidential high-use properties, and replace the excavated soil with 9 to 12 inches of imported soil. The 11 sites (see Figure 2) totalled about 15 acres and included playgrounds, parks, and vacant lots - locations where children were likely to spend time playing. While additional information was required to fully characterize the nature and extent of contamination in the residential community, these nonresidential sites were selected for early remedial action because of elevated concentrations of arsenic in soil, and accessibility by the public, especially children. A portion of one of the sites has not been cleaned-up due to difficulties in securing access from the property owner.

Remedial Investigation/Feasibility Study

In 1989, EPA contacted Asarco about conducting the further investigation and analysis of cleanup alternatives. Asarco was not willing to conduct the investigation and analysis as required by EPA, so EPA funded and performed this work. EPA released its Baseline Risk Assessment, RI, and Feasibility Study in January 1992.

2.2 Cleanup Activities at the Smelter Site

In addition to the investigation and cleanup of the residential community, EPA and Asarco are also investigating and analyzing cleanup options for the smelter property, and for contaminated marine sediments adjacent to the smelter site. See Section 4.0 for a brief description of these activities.

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

Throughout EPA's RI/FS activities leading up to this ROD, extensive efforts have been made to inform and involve the public, particularly residents in the community. EPA conducted the activities summarized in this section because the agency believes that community involvement is a key element in developing and implementing a successful cleanup plan.

In addition to the many activities discussed below, EPA has complied with the specific requirements for public participation under CERCLA by publishing a Proposed Plan for public comment on August 14, 1992. The Proposed Plan public comment period ran from August 17, 1992 through October 17, 1992. During the comment period EPA held two public meetings. The Proposed Plan was mailed to approximately 800 individuals on EPA's mailing list. A summary fact sheet of the Proposed Plan was also sent to all residents of the Study Area by a postal carrier route bulk mailing. EPA also published newspaper advertisements in Tacoma's Morning News Tribune to announce the availability of the Proposed Plan, the comment period, and the public meetings.

To prepare for the release of the Proposed Plan, EPA developed a communications strategy in 1990 for its activities related to the Ruston/North Tacoma Study Area. The communications strategy included three main components: Community Relations; Periodic Briefings; and the formation of a Coordinating Forum. This strategy supplemented the existing Community Relations Plan (September 1989), which addresses all of the CB N/T Operable Units. The following summarizes the numerous community relations activities that EPA has conducted to date. Many activities are on-going activities. The activities are listed below as either outreach or education.

3.1 Outreach

General Public

Community Liaison: In 1989, EPA hired a part time community liaison. The EPA liaison staffs an office in Ruston three days a week to answer questions and research information for citizens. He also participates in many of EPA's public involvement activities, including speaking at local community organization's meetings. EPA staff in Seattle also respond to numerous public telephone inquiries.

Community Workgroup: Also in 1989, EPA began a Community Workgroup. Community members were invited to attend by way or a fact sheet that was mailed to residents throughout the Study Area. EPA has since been meeting regularly with the workgroup. EPA often presents ideas to the group for outreach efforts as well as draft language for public information documents (fact sheets, brochures) for feedback and comments. The workgroup provides valuable input to EPA.

Open houses: In January 1991 EPA held three open houses to provide citizens in Ruston and North Tacoma an opportunity to meet representatives of EPA, and to hear the citizens interests and concerns about EPA's efforts to conduct an RI/FS. The open houses were advertised through a notice which was mailed to the Study Area and through newspaper advertisements.

Community interviews: During February, March, and April 1991 EPA interviewed 46 concerned people in the Ruston and North Tacoma communities to learn about community concerns, desired involvement in the project, and suggestions about how to best involve the entire community.

Public Comment Periods: From February 17 through April 17, 1992 EPA held a 60 day public comment period on its RI, Risk Assessment, Feasibility Study and other documents in the Administrative Record. This was the first of two public comment periods to provide residents and officials an opportunity to comment on the cleanup alternatives considered by EPA.

The second comment period, which ran from August 17 through October 17, 1992 focused on EPA's Proposed Plan including the preferred clean-up alternative. Comments received during these two public comment periods are summarized along with EPA's responses in the attached Responsiveness Summary (Appendix A).

Community Workshops/Public Meetings: During the first public comment period, community workshops were held on March 11 and March 31, 1992. Both workshops were well attended (approximately 100 people attended the first workshop and 200 attended the second). The purpose of the workshops was to provide an opportunity for residents to ask questions, provide comments, and learn more about the cleanup alternatives for the site. A transcript was taken of the March 31 meeting, and EPA has prepared a summary of the March 11 workshop. The transcript and summary are available in EPA's Administrative Record for the Study Area (see Table 1).

During the second public comment period EPA held two public meetings. At the meetings, participants learned more about EPA's Proposed Plan and preferred cleanup alternative and had the opportunity to provide public comments. Transcripts were taken of these two meetings (held September 2 and October 1, 1992). The transcripts are available in EPA's Administrative Record for the Study Area (see Table 1).

Small group meetings: Upon request, EPA staff have attended group meetings such as bankers and appraisers associations, Kiwanis, rotary and garden clubs, senior citizens centers, schools, and citizens groups. EPA interacts with these groups in order to educate interested groups about EPA's activities, and to learn about different groups concerns and needs for information about the site. EPA staff continue to meet with small groups as requested.

Elected Officials/Local Government

Periodic Briefings: Briefings have been held for the Town of Ruston, City of Tacoma, Tacoma Environmental Commission, Congressman Norm Dicks and other interested government officials.

Coordinating Forum: In March 1991, EPA established a Coordinating Forum to facilitate discussion and coordination among the various entities involved and/or affected by this project, and to assist in the development and selection of a remedy that would be implementable in the communities. The Forum met monthly from March 1991 through April 1992. The participants included elected officials, key agency decision makers, management, and staff of various organizations including:

Agency for Toxic Substances and Disease Registry
Asarco
City of Tacoma
Metropolitan Parks District
Puget Sound Air Pollution Control Authority
Tacoma-Pierce County Health Department
Town of Ruston
Environmental Protection Agency
Washington Department of Ecology
Washington Department of Health
Washington Department of Labor and Industries

In March 1992, the Coordinating Forum published preliminary findings regarding Community Protection Measures (CPMs) associated with each cleanup alternative, and posed issues for consideration in developing a preferred cleanup alternative. EPA continued to work with key representatives of the Forum to develop the CPMs outlined in Section 9.10 of this ROD.

Real Estate Professionals

On June 18, 1992 EPA joined with Ecology, the City of Tacoma, and Town of Ruston to co-sponsor a seminar on property transactions for realtors, appraisers, banking professionals and legal counsel who conduct business in the Study Area. To publicize the event, EPA issued an open invitation to a mailing list of those who had contacted the agency with questions and concerns.

Nearly 100 people attended the seminar. EPA presented information on its preliminary plans for the cleanup, and on the issue of liability, and then opened the floor for discussions among the professionals. EPA prepared a summary of the seminar for public information.

3.2 Education

Information Repositories: EPA has established ten repositories where citizens can review detailed information about Superfund activities in the Tacoma area. Documents subject to public comment can also be found in these locations. The repositories, frequently advertised in fact sheets and in newspaper notices prepared by EPA, are listed in Table 1.

Fact Sheets and Brochures: Fact sheets and brochures have been prepared by EPA for distribution to members of the community to provide current information on the status of site activities. Table 2 includes a list of fact sheets and brochures published about the Study Area. Fact sheets which exclusively discuss the ERA activities have been excluded.

4.0 SCOPE AND ROLE OF OPERABLE UNITS

The EPA has divided the CB N/T site into seven operable units (OU's) in order to facilitate the investigation, analysis, and cleanup of this very large site. Four of these OU's are associated with the Asarco smelter:

- OU 02 Asarco Tacoma Smelter
- OU 04 Asarco Off-Property (Ruston/North Tacoma Study Area)
- OU 06 Asarco Sediments
- OU 07 Asarco Demolition

The remedy described in this ROD addresses OU 04 and primarily involves the cleanup of arsenic and lead contaminated soils in the residential community surrounding the smelter.

4.1 Scope of Current Work

OU 04. Asarco Off-Property (Ruston/North Tacoma Study Area)

EPA believes that current conditions in the Study Area pose unacceptable risks over the long-term to its current and future residents, and that cleanup actions are therefore necessary. EPA's goal is to reduce potential exposures to arsenic and lead by physically removing contaminated soil to the extent practicable. Removal of contaminated soil will also reduce the contaminants that are transported into homes or other buildings.

EPA estimates that 273 acres of land including 525 residential lots will require cleanup due to the presence of lead and/or arsenic contaminated soil, and slag. The remedy selected in this ROD includes sampling of individual properties to determine if soil exceeds the action levels, excavation of contaminated soil and slag, replacement of excavated soil and slag with clean soil and gravel, asphalt capping or soil removal and replacement with gravel of contaminated dirt alleys and parking areas, fencing and planting low lying shrubs in steep areas, and the development and implementation of community protection measures. These actions will address the principal threat posed by conditions at the site which is the ingestion of contaminated soil and dust.

The remedy selected in this ROD applies to those properties or areas located within the Study Area, as well as the three areas located directly to the south of the Study Area where sample results show that soils exceed the action levels. Available data suggests that contamination above background concentrations exists beyond the Study Area. It is possible that some additional properties beyond the Study Area, particularly to the south-southwest, also have soils exceeding the action levels and may require cleanup. EPA will evaluate the need for further sampling and appropriate cleanup activities outside of the Study Area separately from the current action, and at a later date.

4.2 Other Related Activities

OU 02. Asarco Tacoma Smelter, and OU 07. Asarco Demolition

In September 1986, EPA and Asarco signed an Administrative Order on Consent under which Asarco agreed to conduct investigation, analytical, and site stabilization activities at the smelter site under EPA oversight. Site stabilization activities, including removal of some of the most contaminated structures, were conducted by Asarco in 1986 and 1987. The investigation and analysis for the cleanup of soil, surface water, and ground water at the smelter site is anticipated to be completed in the Fall of 1993. Following completion of these activities, EPA will issue for public review and comment a Proposed Plan for the cleanup of the smelter site.

In the meantime, Asarco is completing the demolition of remaining structures under a federal Consent Decree with EPA signed in 1991. Demolition of remaining structures is expected to continue through 1994-95. Also under this Consent Decree, Asarco installed controls on surface water that runs onto the site to minimize the contact of surface water with contaminated soil.

OU 06. Asarco Sediments

EPA is analyzing cleanup options for contaminated marine sediments adjacent to the smelter property. EPA anticipates releasing a Feasibility Study and a Proposed Plan, for public review and comment, in the summer of 1993.

5.0 SITE CHARACTERISTICS

5.1 Sources of Contamination

Asarco smelter operations resulted in the deposition of arsenic, lead, and other contaminants from smelter emissions to the surrounding areas. Soils in the community are currently contaminated as the result of the accumulation of deposited materials over the operating history of the smelter. Areas closest to the smelter have been most affected by various low-level fugitive[1] emissions sources from smelting operations. Areas at greater distances from the smelter have been most affected by tall stack emissions.

1 Fugitive emissions are emissions from smelter processes that were not captured by a filter or similar control system.

In addition to the deposition of airborne contaminants released from the smelter, smelter slag has been used at a number of locations in the surrounding community. Slag was produced as a by-product of smelting operations. Typical uses of slag in the community include driveway, walkway, or curbside aggregate, parking area surfacing, and backfill in utility trenches. No inventory of slag use in the community is available.

5.2 Nature and Extent of Contamination

Based upon the results of previous investigations regarding the impacts of smelter operations on the surrounding area, the RI was designed to focus on the area most likely to require cleanup, on soils as the primary environmental medium of concern, and on arsenic as the primary contaminant of concern. The RI was also designed to expand upon the existing information known about arsenic and other contaminants in soils as presented in the FIR (see Section 2.0 for a brief discussion of the FIR) and earlier soils studies.

During the RI, 222 soil samples were collected to provide additional information on the distribution of arsenic and other metals in surface and subsurface soils in the Study Area. Samples were collected at three depths (surface, 6 to 10 inches, and 12 to 16 inches) at selected locations. Samples were collected to fill data gaps, i.e., where little or no previous information existed, to increase confidence in the arsenic distribution defined by previous FIR data, to provide information on the vertical extent of arsenic contamination in soil, and to determine if arsenic was concentrated or dispersed in areas such as gullies, parking lots, and alleys. Samples were collected from residential properties as well as nonresidential areas including unpaved streets, alleys and parking lots, and storm drains and ditches.

All soil samples collected during the RI were analyzed for arsenic. In addition, selected samples were analyzed for antimony, cadmium, copper, lead, mercury, and silver. This subset of metals was selected for evaluation due to their previously identified high correlations, and their presence in smelter feedstocks.[2] Samples were also analyzed for physical parameters related to the possible movement of arsenic in the environment including leachability, soil particle size, and pH.

Table 3 provides a summary of metals concentration data for residential surface and subsurface soil samples. The table includes results for the combined RI and FIR data sets. The soil sampling results demonstrate the presence of metals above background concentrations in area soils. (See sections 4.1 and 4.5 of the RI for additional information on comparisons of sample results to background concentrations.) As a result of an evaluation conducted in the EA, local urban background concentrations for arsenic and lead have been characterized as 20 ppm and 250 ppm respectively (see Section 2.0 for a description of the EA).

Arsenic and lead are the two contaminants of primary concern for human health (see Section 6.1 of this ROD). Therefore, the selection of action levels and the cleanup activities called for in this ROD, are focused on arsenic and lead. Because the other metals identified above are generally found at elevated concentrations at the same locations as arsenic and lead, cleanup measures to reduce exposures to arsenic and lead will be effective in reducing exposures to the other metals.

The RI study data indicates that there is an overall pattern of decreasing contaminant concentrations with increasing distance from the smelter, with a directional component reflecting wind patterns. Soil concentrations, however, vary from one property to another within the Study Area, probably reflecting in large part human activities that have disturbed surface soils. While soil concentrations generally decrease with depth, other patterns of arsenic distribution with depth were also identified. In general, these patterns were observed at locations where information suggested that the soil had been disturbed. While the collection of soil samples for the RI did not extend much

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[2] Smelter feedstocks are the raw copper-bearing material that was fed into the smelter.

below a depth of one-foot, it is possible that contamination may exist deeper than one foot in some areas.

Figures 3 and 4 identify the combined RI and FIR soil sampling locations and concentrations for arsenic and lead respectively. The data for arsenic are plotted on Figure 3 in the form of color-coded symbols corresponding to the following concentration ranges: 0 to 46 ppm; 47 to 230 ppm; 231 to 400 ppm; 401 to 800 ppm; and greater than 800 ppm. These ranges were selected to illustrate the wide range of arsenic concentrations found within the Study Area. Approximately 81 percent of all surface soil samples collected in the Study Area exceed 46 ppm. Approximately 34 percent of all soil samples exceed 230 ppm - the arsenic action level selected in this ROD. Nineteen percent of all soil samples exceed 400 ppm, and 5 percent exceed 800 ppm.

The highest levels of soil arsenic, i.e., above 800 ppm, occur within a small area near the smelter property. Areas that are further away from the smelter generally show lower levels of both soil arsenic and lead contamination. At these lower levels, much larger areas including greater distances from the smelter are included. The area where impacts from the Asarco smelter can no longer be detected in soil (i.e., where arsenic concentrations in soil would be within urban background levels of 20 ppm) is estimated to be well beyond the Study Area (see Section 4.3.1. of the RI for further information on the possible extent of contamination beyond the Study Area). It should be noted, however, that some samples taken from within the Study Area were also below estimated urban background levels for arsenic and lead.

Based upon consideration of all RI and FIR soil data, and the selected action levels for arsenic and lead, EPA estimates that 273 acres of land, including approximately 525 residential lots, may require cleanup action. This includes driveway slag or slag of smaller size used for other purposes, but would not include large pieces of ornamental slag. Estimated portions of the Study Area most likely to require cleanup are shown in Figure 5.

5.3 Contaminant Migration

The results of the RI indicate that samples from unpaved streets and alleys were generally lower in arsenic content than residential surface soil samples taken in the same vicinity. Erosion, new road base material, and vehicular tracking may account for redistribution of arsenic-bearing soil particles and thus the lower arsenic concentrations in the unpaved street samples.

Historical studies through the 1970's and 1980's showed elevated contaminant concentrations in multiple environmental media, including soils, house dusts, indoor and outdoor air, and garden vegetables. Since copper smelting and arsenic processing ceased, ambient air concentrations have been reduced by more than 90 percent. The remaining soil contamination, however, is likely to continue to affect other media by contaminant transport and mobility, e.g., tracking of soil into houses and releases of fugitive particulates to ambient air. The most important transport mechanisms of soil, dust, and slag particles containing arsenic and lead appear to be through resuspension, redeposition, and tracking. Therefore, the selected remedial actions (excavation of contaminated soil and replacement with clean soil) will likely reduce contamination and potential exposures from other site environmental media, e.g., house dust, over the long-term.

Based upon the results of the RI, EPA has concluded that soil arsenic and lead are unlikely to experience substantial leaching or downward movement in Study Area soils due to infiltration of water. In addition, naturally occurring fate and transport processes appear unlikely to significantly reduce soil arsenic or lead concentrations in the near term. Without remediation, or the altering (disturbing) of soil, contaminant concentrations in soil are expected to remain at or near current levels for decades.

5.4 Affected Population

The current and future residents of Ruston and North Tacoma, especially young children, are the populations with potential exposures and health risks. The areas surrounding the Asarco smelter have for some time been largely developed in single family residential land use. A sizable population currently lives in the areas with soil concentrations exceeding background levels. An estimated 4,000 people live within a distance of approximately one mile from the smelter (roughly equivalent to the area with soil arsenic concentrations at or above 100 ppm, but including some lower concentrations).

6.0 SITE RISKS

Operation of the Asarco smelter for a period of more than 90 years resulted in residual contamination of the environment, particularly soils, in the surrounding areas of Ruston and North Tacoma. Potential exposures and health risks for current and future residents resulting from that residual contamination were evaluated in a risk assessment. Children are of special concern because their typical behaviors, like playing outdoors and various hand-to-mouth activities, may result in exposure to soil contamination. Children are also particularly at risk for some effects of exposure to metals, especially lead.

Risk assessment for a Superfund site is a four-step process. The first step, data collection and evaluation, identifies the contaminants at the site. The second step, toxicity assessment, uses the results of years of research and testing of the effects of chemicals on the health of people and animals to decide which of the contaminants found at a site might pose a health threat. The third step, exposure assessment, defines how people might contact the contaminants and how much of the contaminant may enter their body. The final step, risk characterization, brings the information from the first three steps together to determine the potential severity of health threats from the site.

The following sections provide a summary of the human health and ecological risk assessments, as well as EPA's risk management decisions regarding the selection of remedial action objectives and goals.

6.1 Identification of Contaminants of Concern

EPA evaluated metals which were known to be associated with the smelter (antimony, cadmium, arsenic, copper, mercury, lead, selenium, silver, and zinc). Two were determined to be of particular concern for human health: arsenic and lead. EPA determined that the other metals did not individually pose significant risks to the community even at the highest levels detected in Study Area soils.

6.2 Exposure Assessment

Six exposure scenarios were evaluated in the risk assessment: (1) ingestion of soils and house dusts; (2) ingestion of garden vegetables grown in contaminated soils; (3) dermal contact with contaminated soils; (4) inhalation of particles in the air, either outdoors or indoors; (5) ingestion of slag and house dusts derived from slag; and (6) ingestion of soils and house dusts by a child with pica (ingestion of abnormally high amounts of non-food substances, such as soil). The scenario of most concern to EPA is the ingestion of soils and house dusts because it was estimated to result in the highest potential exposures of all of the scenarios evaluated. Several of these scenarios, for example, pica soil ingestion, slag ingestion, and garden vegetable ingestion, would only apply to certain residents.

For arsenic, site-specific data were combined with EPA's standard exposure assumptions (e.g., living at a residence for 30-years) to estimate the amount of arsenic taken into the body on a daily basis (the exposure). Exposures were estimated at five soil arsenic concentrations ranging from

140 ppm to 1,600 ppm. These values represent a range of soil concentrations occurring in the Study Area. Tables 4 and 5 summarize the exposure factors and the arsenic concentrations in each exposure scenario for which exposures and risks were calculated. Tables 6 and 7 summarize the amount of arsenic estimated to be taken into the body for the different exposure scenarios (media-specific intake rates). The site-specific data used in the exposure assessment included:

- air monitoring data for arsenic at sites near the Asarco property boundary;
- soil data from the 1988 FIR;
- soil data from the RI;
- slag data, including sampling of driveway slag and house dusts at three sites remote from the smelter; and
- garden vegetable tissue concentrations from local studies to evaluate contaminant uptake in relation to garden soil concentrations.

Typical background exposures to arsenic from normal diet, drinking water, and air sources were compared to estimated exposures from contaminated community soils. Estimated exposures from the more highly contaminated soils were several times greater than typical background exposures.

For lead, possible childhood lead exposures were calculated using the "LEAD4" model developed by EPA. This model considers multiple potential pathways for childhood lead exposures and predicts a distribution of blood lead levels for discrete age intervals. The exposure assumptions used in the model are summarized in Table 8. Table 9 summarizes the amount of lead estimated to be taken into the body (intake rate) at different soil lead concentrations ranging from 20 ppm to 2,700 ppm. These values represent a range of soil concentrations occurring in the Study Area.

6.3 Toxicity Assessment

In the risk assessment, EPA evaluated the potential human health effects from exposure to arsenic and lead. These effects are discussed below.

Arsenic

Both cancer and noncancer outcomes are associated with exposure to arsenic. Studies have demonstrated that ingestion of arsenic is associated with an increased risk of skin cancer, and inhalation of arsenic is associated with an increased risk of lung cancer. Estimated risks for these types of cancer have been calculated by EPA. There is also evidence that ingestion of arsenic can result in cancers of other organs (e.g., liver, lung, bladder, and kidney). These additional cancer risks, however, were not calculated in the risk assessment because EPA has not adopted the necessary information to estimate risks for these cancers.

Noncancer risks from the ingestion of arsenic include skin hyperpigmentation and skin keratoses. At higher exposure levels, other possible noncancer effects include vascular, neurological, and gastrointestinal disorders. Death from exposure to high environmental levels of arsenic (well above those occurring at this site) has been documented.

Lead

Exposure to lead at elevated concentrations can affect many systems of the body. At lower environmental concentrations, the primary concern is for learning and behavioral effects in young children. The best indicator of lead exposure is lead levels in the blood. Recent studies show that IQ and attention span effects can be correlated with slight increases in blood lead levels. Based on these recent studies, acceptable childhood blood lead levels have been reduced to 10 micrograms of lead per deciliter of blood (ug/dl). That blood lead level is used in the risk assessment as a value against which to assess risks from lead exposures.

6.4 Epidemiological Studies

Several health (epidemiological) studies on community residents living near the smelter have been performed. These include studies to determine if lung cancer deaths or adverse effects on the fetus (e.g., lower birth weight or birth defects) occurred at higher than normal levels in the community due to smelter contaminants. These studies have not found statistically significant increases in adverse health effects associated with arsenic exposures. This lack of observed health effects, however, does not contradict EPA's risk assessment since the relatively low levels of risk of concern to EPA would be difficult to observe or measure in community health studies. Further, no epidemiological studies have been performed in the Study Area for the effects identified in the risk assessment as being of greatest concern for ingested arsenic exposure - skin cancer and other skin effects.

While not statistically significant, one lung cancer study of community residents did suggest a possible arsenic relationship for lung cancers. The level of arsenic in the air in the community at the time of exposure, however, was much higher than current levels, and therefore does not directly contribute to understanding current risk estimates.

Urinary arsenic monitoring in the Ruston and North Tacoma area has been done periodically since the early 1970's. The most recent scientifically designed survey conducted by the TPCHD in 1988 showed some significantly elevated values, although the average levels appear to have dropped since closure of the smelter.

There are also no recent blood lead measurements in children from Ruston and North Tacoma. The only available blood lead data, from the 1970's, reflects much higher automobile emissions of lead from gasoline and generally higher urban air lead levels, and are not relevant to current conditions.

6.5 Risk Characterization

Arsenic/Cancer Risk

Information on the toxicity of arsenic and the calculated exposures in the Study Area was combined to estimate the skin and lung cancer risks for individuals living in the Study Area (see Table 10). Estimated risks will vary depending on the arsenic concentrations in individual yards. On Table 10, risks at 800 ppm soil arsenic concentration are used as an example to show the reasonable maximum exposure - the highest exposure reasonably expected to occur. Only 5 percent of the Study Area is expected to have soil concentrations exceeding 800 ppm. Risks will be less for those areas with lower soil arsenic concentrations.

Cancer risks for the air inhalation pathway represent risks of lung cancer. The cancer risks for all other pathways represent skin cancer. The estimated air inhalation lung cancer risks are based on monitoring data collected near the smelter property boundary. Lung cancer risks are expected to decrease with increasing distance from the smelter. The highest risks for skin cancer result from the ingestion of soil/house dust and slag/house dust. The skin cancer risks from the dermal absorption and garden vegetable pathways are small in comparison. Pica behavior, as modeled in the risk assessment, would result in approximately a doubling of skin cancer risk compared to the non-pica individual.

Arsenic/Noncancer Risk

For noncancer effects, EPA develops a "Hazard Quotient" to estimate the potential risks from ingestion and dermal absorption of arsenic in Study Area soils (see Table 11). As the Hazard Quotient rises above a value of "1", the potential for noncancer effects increases.

The dermal absorption and garden vegetable exposure pathways have hazard quotients below 1.0, indicating no significant risks of noncancer outcomes (adverse skin effects). Potential soil and house dust exposures, as well as the case-specific exposures to slag and for a pica child, have hazard quotients above 1.0 (ranging from 2.2 to 16.0) indicating the potential for adverse skin effects in the exposed population.

Lead

The "LEAD4" model was used to estimate the potential for a child to exceed a 10 ug/dl blood lead level at various soil lead concentrations within the Study Area. Soil lead data is available from 41 locations within the Study Area (see Figure 4). The potential for a child to exceed a 10 ug/dl blood lead level, based on the soil lead data, varied from 1 percent to 98 percent.

6.6 Uncertainty in the Risk Assessment

The risk assessment document includes a discussion of the uncertainties in the estimation of exposures and risks. Since these risks are generally derived in a conservative manner, they have a low likelihood of being underestimates. The actual risks could be lower than the estimates shown for those effects considered in the risk assessment. However, as noted above in Section 6.3, other types of cancer (liver, lung, bladder and kidney), for which no risk estimates have been derived, have been associated with ingestion of arsenic. Possible risks for these additional adverse effects may therefore be in addition to those estimated in the risk assessment.

6.7 Potential Health Risks Exceed Acceptable Levels

As a general policy, EPA uses the results of the baseline risk assessment to determine if remedial action is warranted at a Superfund site. According to the National Contingency Plan (NCP) and EPA guidance, action under Superfund is generally warranted for cancer effects when the baseline risk assessment indicates that an individual's excess lifetime cancer risk, using reasonable maximum exposure assumptions exceeds 10^{-4}.[3] For noncancer effects, potential health risks increase as the Hazard Quotient rises above "1". For lead, EPA has determined that unacceptable risks occur when an individual has greater than a 5 percent chance of exceeding a blood lead level of 10 ug/dl.

For both arsenic and lead, the estimated exposures and risks in the Study Area exceed those levels that generally require remedial action at a Superfund site as defined by EPA in the NCP and program guidance. Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

6.8 Remedial Action Objectives and Goals

The remedial action objectives and goals identified by EPA and included in Table 12 are based upon the results of the risk assessment, and a number of other risk management considerations including the scope, costs, and impact on the community of remedial actions, as well as community acceptance of the remedy. Further information on how EPA considered these factors in the selection of the action levels for the site can be found in EPA's January 1992 *Ruston/North Tacoma Site Preliminary Remedial Action Objectives Decision Memorandum.*

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[3] EPA's acceptable risk range is defined in section 300.430(e)(2)(i) of the NCP as 10^{-4} to 10^{-6}. EPA guidance provides that "10^{-4}" can include estimated risks slightly above 1×10^{-4} if justified based on site-specific information (Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions, OSWER Directive 9355.0-30, April 22, 1991).

The remediation goals or action levels identified by EPA are 230 ppm for arsenic and 500 ppm for lead. Properties or areas that exceed these action levels will require cleanup. The arsenic action level of 230 ppm is based on reducing the additional potential skin cancer risk to no more than 5 in 10,000, within EPA's acceptable risk range for cancer causing chemicals.[4] The 500 ppm action level for lead is based upon a national goal of reducing levels in children's blood to no greater than 10 ug/dl, as well as EPA guidance that recommends establishing soil lead cleanup levels of 500 to 1,000 ppm.

In addition to being protective of human health and the environment, any final site remedy must also comply with applicable or relevant and appropriate requirements (ARARs). The Washington State MTCA cleanup standards are applicable requirements for the Ruston/North Tacoma site.

EPA has coordinated with Ecology in evaluating the MTCA requirements. Under MTCA Method A, the soil cleanup levels for residential areas are 20 ppm for arsenic and 250 ppm for lead. MTCA requires that some form of action be taken to address contamination above these levels. In evaluating the available remedial actions to address contamination at this site, Ecology has considered the nature and extent of site contamination, the nature of human health risks, the exposure pathways, and the potential impacts and costs associated with physical remediation activities in the community. Ecology concluded that the EPA action level of 230 ppm for soil arsenic represents a best balancing of factors for a level at which engineering actions (e.g., soil removal) for remediation should begin at this site. For lead, Ecology can elect to use the conservative Method A cleanup level of 250 ppm, or it can use site-specific information and the latest version of EPA's biokinetic model to establish a cleanup level (see WAC 173-340-702(6)). Ecology has determined that the results of applying the "LEAD4" model support setting the soil lead cleanup level under MTCA at 500 ppm for this site.

CPMs (discussed further in Sections 7.0 and 9.10) will be used to address the residual risk presented by soils which have arsenic concentrations between the MTCA cleanup level of 20 ppm and the EPA action level of 230 ppm.

6.9 Environmental Risks

The approach used in the ecological risk evaluation (Technical Memorandum: Ecological Risk Evaluation, EPA, July 1992) was to compare site-specific soil concentrations with data from scientific literature. The few available site-specific ecological studies were considered, but differences in site conditions during and after smelter operations limited the application of those results.

The primary contaminants of concern for potential ecological effects in the Study Area were identified as arsenic, copper, and lead. Soil, plants, invertebrates (earthworms and insects), small mammals, birds, and pets (e.g., dogs and cats) were considered in the evaluation.

Current soil contaminant concentrations in the Study Area appear likely to cause adverse effects on some plants and soil invertebrates. Small mammals and birds feeding on soil invertebrates could also have elevated tissue levels of the contaminants of concern. Based on a simplified exposure and risk assessment, small mammals in the most contaminated parts of the site could experience adverse health effects. Larger mammals, including pets such as dogs, are not anticipated to be at substantial risk from potential exposures to soil contaminants. Uncertainties in the extent, severity, duration, and significance of possible adverse ecological effects at this site are relatively high because of the lack of site-specific studies.

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[4] EPA's "Ruston/North Tacoma Site Preliminary Remedial Action Objectives Decision Memorandum" documented why an action level corresponding to a 5×10^{-4} level was warranted based on site-specific considerations.

Copper is typically a contaminant of concern in ecological risk studies. The human health risk assessment, however, identified only arsenic and lead as the contaminants of primary concern. Action levels for arsenic and lead have been identified by EPA (see Section 6.8). Although there is no risk-based action level for copper, copper has been shown to be highly correlated with arsenic and other smelter-related metals in Study Area soils, reflecting the significance of smelter emissions as a source of these metals. As a result, remediation for arsenic and lead would also address most areas of elevated copper concentrations.

It is possible that there could be some ecological effects associated with remaining soil contamination after the cleanup. Such effects, if any, are likely to be relatively subtle and limited in magnitude. Other factors related to typical urban activities and land use changes could also effect plants and animals in the Study Area. Any ecological effects from residual contamination below the action levels may be difficult to distinguish from the effects of these other factors.

EPA has considered the information in the ecological risk evaluation in selecting action levels for site soils. It appears likely that the selected action levels for human health would also reduce potential ecological effects to levels that are, at worst, relatively hard to detect and of little consequence given the existing effects of urban land uses throughout the Study Area. Therefore, the selected action levels were determined to be adequately protective of ecological risks at the site.

7.0 DESCRIPTION OF ALTERNATIVES

In the FS, EPA developed and considered six alternatives for cleanup of soils contaminated as a result of emissions from the Asarco smelter. The FS alternatives included varying degrees of cleanup activities that would apply to residential lawns, garden areas, commercial properties, open park lands, empty lots, unpaved streets and alleys, and other exposed soil surfaces or areas where arsenic and/or lead concentrations exceed EPA's cleanup goals.

EPA's Preferred Alternative, described and issued with the Proposed Plan, combined elements from several of the six FS alternatives. EPA considered several general principles and guidelines (see section 7.8) when deciding upon the Preferred Alternative. The Preferred Alternative was presented as the best balance of benefits and tradeoffs for the Ruston/North Tacoma community for consideration during public comment. The Preferred Alternative has since been further modified by public comment.

Except for the "No Action" alternative, the cleanup alternatives were designed to reduce exposure to contaminated soil and dust, as well as to reduce the potential transport of soil contaminants inside homes and other buildings. While EPA believes that the cleanup action must reduce the likelihood of exposure to contaminated soil, it is also important that residents enjoy the fullest use of their properties.

While not discussed in the soil cleanup alternatives listed below, cleanup activities would also include the remediation of slag from driveways, and from other areas within the Study Area where slag use could lead to potential human exposures. In areas where slag is removed, it would be replaced with gravel.

During the technology screening process conducted as part of the FS, EPA considered a range of treatment options and conducted a soil washing treatability study. The results of the screening process and the treatability study indicated that treatment is neither practical nor effective in reducing contamination levels. Treatment alternatives, therefore, were dropped from further consideration.

In addition, each alternative with the exception of "No Action" includes provisions for implementing community protection measures within the Study Area. Community protection measures (described below) were deemed necessary for any alternative under which contaminated soil would be left in place. This includes areas where arsenic remains in soil in concentrations above the action level, (e.g., below a soil cap or paved road), as well as areas where arsenic and lead exceed concentrations normally found in urban areas, but are below the action levels.

The following section describes the six FS alternatives, the common components of the alternatives, the general principles and guidelines that guided EPA in composing the Preferred Alternative, as well as a description of the Preferred Alternative. Tables 13 and 14 provide a comparative summary of the alternatives.

7.1 Alternative 1 - No Action

The No Action alternative is required by law to be evaluated and provides a baseline for comparison against other alternatives. Under this alternative, there are no physical remediation activities or community protection measures. Because no remedial activities would be implemented, there would be no reduction in the current potential risks from exposure to residential soils and dust, i.e., risks would be essentially the same as those identified in the baseline risk assessment.

Total Estimated Present Worth Cost	None
Estimated Time to Complete	Not Applicable

7.2 Common Components of the Alternatives

Except for the No Action alternative, all of the remaining alternatives have some components in common. These components are described below and are not repeated in the discussions of each alternative.

a. Common Components of Alternatives 3 through 6 and the Preferred Alternative

Extent of Remediation

Soil removal or containment activities at properties or areas that exceed EPA's action levels generally would address sod areas (residential and commercial), landscaped areas, garden areas, unpaved driveways, and roadway shoulders. A "marker," e.g., a porous geotextile or geocomposite material, would be placed at the base of the excavation to demarcate for future intrusions the maximum depth of the excavation. Excavated soil would be replaced with "clean" soil, i.e., soil with concentrations of arsenic less than 20 ppm and lead less than 250 ppm. Even lower values for the replacement soils, especially for lead, are likely achievable, e.g., lead less than 100 ppm. Soil would not be removed from beneath sidewalks, driveways, streets, or other paved areas.

Dirt alleys and parking areas where soils exceed the action levels would be paved with asphalt to provide an impermeable barrier to contamination. The total area to be covered with asphalt was estimated, with the use of aerial photographs and site visits, to be about 5 percent of the total site Study Area (approximately 14 acres). This area is based upon the assumption that all dirt alleys and unpaved areas contain soil lead and arsenic at concentrations above action levels and therefore require remediation.

Steeply sloped areas (see Figure 6) which could not be capped with asphalt, graveled, or sodded would be fenced and planted with low-lying shrubs. A geotextile fabric would be used to aid in the growth and development of natural vegetation, as well as in the reduction of erosion.

Vegetation Removal and Replacement

The lawn areas of remediated yards would be revegetated with sod and maintained to ensure that the grass cover is well established. To the extent possible, yard landscaping would be returned to its original condition. Sod and any fertilizer would be applied by a landscape contractor using-conventional construction equipment. Shrubs and other types of groundcover would be planted by hand (see Section 9.10 (c) below for information on cap maintenance procedures).

Reasonable attempts, which do not hinder the progress of the remediation and are not excessively costly, would be made to accommodate owners who wish to retain original landscaping. The actual vegetation removal and replacement plan would be determined on a property-by-property basis in conjunction with the property owners.

Safety Measures During Remediation

During implementation of the cleanup, safety measures would include, at a minimum, the use of health and safety monitoring equipment and personal protection gear, the use of dust suppression techniques during excavation activities, lining and covering truck beds when transporting contaminated materials, removing soils from truck wheels before trucks travel on public roads, the establishment of local truck routes to minimize disruption to the community, provisions for road maintenance and repair if improper measures (e.g., excess loads) result in damage to roads, and covering of any stockpiled materials.

Disposal

Under current state law (Dangerous Waste Regulations), removed soil with arsenic concentrations greater than 100 ppm is considered a dangerous waste and requires disposal at a hazardous waste facility. There are no such facilities available in the state of Washington at this time. The Department of Ecology is currently evaluating a petition by Asarco to exempt residential soils from the disposal criteria in the Dangerous Waste Regulations. If approved, additional disposal options could become available in the future. EPA, therefore, considered several possible disposal options in the FS including an out-of-state non-hazardous waste facility operated by Finley Buttes Landfill Company in Arlington, Oregon, an out-of-state Class I hazardous waste facility in Arlington, Oregon owned by Chemical Waste Management, Inc., and disposal on the Asarco smelter property.[5]

The facilities described above were examined as part of the cost estimating process to provide a range of potential disposal fees. For those alternatives where a range of costs is shown, the lower costs reflect disposal of contaminated soil at a nonhazardous waste facility, and the higher costs indicate disposal at a hazardous waste facility. All of the alternatives, except for 4a, assume final disposal of contaminated soil at a facility outside of the residential Study Area. Alternative 4a includes disposal on the Asarco smelter property.

Shrubs and other yard waste removed during the remedial action are not expected to be of significant concern due to low arsenic and lead levels. The inclusion of contaminated soils with vegetation during the digging and clearing for remedial actions may be of greater concern than actual plant tissue uptake of arsenic and lead. This waste could be disposed in a municipal solid waste facility within the State of Washington, or routed to the Tacoma urban composting facility, if determined to have minimal concentrations of contaminants.

[5] A determination to dispose of Study Area soils on the smelter property cannot be made in this ROD. An evaluation of the viability of disposing of Study Area soils on the smelter property is being conducted as part of the smelter cleanup process. EPA will seek further public review and comment on this issue when the Proposed Plan for cleanup of the smelter property is issued.

b. Common Component of Alternatives 2 through 6 and the Preferred Alternative

Community Protection Measures

Community protection measures, commonly referred to as institutional controls, are non-engineering measures used to prevent or limit public exposure to soil contamination. These measures could be used as the sole component of remediation (to prevent or minimize exposure to contaminated soil), or in conjunction with an engineering action (to ensure that the technology is implemented and remains effective). Alternative 2 relies upon community protection measures as the sole remediation component. Varying degrees of community protection measures would be necessary for alternatives 3 through 6 and the Preferred Alternative to the extent that contaminated soil is not removed from individual properties. The objectives for community protection measures for the Ruston/North Tacoma site were defined as follows:

- To control activities that intentionally disturb contaminated soils by providing guidelines or permit requirements for conducting those activities with the minimum amount of contact with or movement of contaminated soil.
- To ensure the long-term integrity of caps (soil, sod, and asphalt) used in the alternatives by providing for maintenance, repair, and inspection of any capped areas.
- To establish a post-cleanup storage/disposal program for contaminated soil.
- To provide a means for notifying potential future property owners if contaminated soil remains at a property, and inform them of the above guidelines and responsibilities.
- To educate the community over the long-term on the above guidelines and responsibilities.

The possible community protection measures, which could be used to meet the objectives identified above, were described and evaluated in the FS and are listed below:

- Development of Policy and Planning Documents
- Land Use and Development Regulations
- Special Legislation
- Real Property Restrictions
- Contractual Agreements with Individuals
- Contractual Agreements with Potentially Responsible Parties (PRPs)
- Public Education and Public Involvement

The effective implementation of community protection measures relies upon the cooperation and involvement of the community and the local officials. Accordingly, the specific community protection measures included in the selected remedy (see Section 9.10) were identified following significant input from the Ruston/North Tacoma Coordinating Forum, the Ruston/North Tacoma Community Workgroup, and public comments given or submitted during two public comment periods associated with the RI/FS and the Proposed Plan.

7.3 Alternative 2 - Limited Action

The limited action alternative would rely solely upon the community protection measures described in Section 7.2b to reduce exposure to contaminants and to achieve the remedial action objectives. Such measures would include controlling soil disturbances, establishing a soil disposal program, notifying future property owners if contamination exists, and implementing public education programs to inform residents on how they can reduce their exposure to contaminated soil.

Total Estimated Present Worth Cost	$3 million
Estimated Time to Complete	Ongoing and Indefinite

7.4 Alternative 3 - Containment of Contaminated Soil

The containment alternative focuses on containing contaminated soil by covering lawns, parks, and other areas of exposed soil with sod, by covering dirt alleys and parking areas with asphalt, and by implementing the community protection measures program identified in Alternative 2.

The implementation of this alternative would involve tilling of existing soil and grass with a rototiller to a depth of about 6 inches. This tilled material would form the subsoil or base for the new sod. Most trees and shrubs would remain undisturbed; only very small vegetation would be removed during the remedial action. In some cases, where existing soil was deemed inadequate to support new sod, additional sandy loam would be applied to form a 2 inch lift. The application of this additional soil would therefore require the removal of an equivalent volume of original soil to maintain original grade. This excavated material would constitute a remedial action by-product which would require disposal.

The subsoil would be prepared (raked and rolled) and covered with a new, clean, 1 inch sod layer. The placement of 1 inch of clean sod may enhance the risk reduction aspect of this alternative over merely applying seed to existing soil. The application of sod would result in a negligible positive change in the grade of each lot. Each home lot (approximate size <1/4 acre) would require at least one day for sod replacement. Based upon a site remediation rate of four average homes-per-day, and a schedule of 20 work days per month, this alternative would require less than 1 year to complete.

Capping and sodding would produce over 26,000 cubic yards of soils which would require disposal. Soil removed during the remedial action would be disposed in a permitted land disposal facility as discussed in section 7.2a. Removed soil would be loaded into dump trucks and transferred into larger dump trailers for transport to Arlington, Oregon. The transfer of materials would be required because many streets throughout the Study Area cannot be easily accessed by the larger vehicles.

Total Estimated Present Worth Cost	$24 to 27 million
Estimated Time to Complete	1 Year

7.5 Alternative 4a and 4b - Excavate 1 Foot of Soil/Backfill/Temporary Storage at Asarco Smelter Facility/Permanent Disposal

This alternative relies primarily on excavation and removal of 1 foot of contaminated soil as a means to comply with the remedial action objectives. The excavated soil would be temporarily stored at the Asarco smelter facility until a decision is made on the location for final disposal. Soil would either be disposed a) on the smelter property, or b) transferred off-site to a permitted disposal facility. Excavated soil would be replaced with clean/uncontaminated soil, regraded to near original grade, revegetated with shrubs, and covered with a layer of sod. If contaminated soil remains at depth following excavation, the clean soil would act as a cap or barrier to the contamination. Community protection measures would include measures to ensure the continued integrity of that cap.

Contaminated soil would be removed from large open areas of the site using graders and front-end loaders. More confined areas would require the use of backhoes and small loaders. For very restricted spaces (as the case may be at many residential lots) hand tools may be required. Excavation would not proceed below the foundation of existing buildings. Implementation of this alternative would begin with mobilization and establishment of truck loading areas, clearing and grubbing, establishment of work areas for contractor offices, and decontamination facilities.

Implementation of this alternative would result in over 187,000 cubic yards of contaminated soil which would require disposal. Approximately 7 years would be required to complete the soil excavation, removal, and replacement at the site. This estimate was based upon a 10-month work year with 20 work days per month. The average remediation rate would be about eight homes per month at 140 cubic yards/day, using seven 35 cubic yard dump trailers per day (actual load capacity 20 cubic yards).

Contaminated soil would be transported to the Asarco facility for storage in a secure area of the site where access could be controlled. Soil would be stored at the Asarco facility until a determination is made regarding the viability of containing the soil on-site. Asarco is evaluating on-site disposal as part of the smelter facility RI/FS for waste associated with smelter demolition and smelter site cleanup. A final determination regarding on-site disposal will not be made until the ROD for the smelter property cleanup is signed. This decision is expected within the next year. Therefore, it is possible that under this alternative soil may be stored on-site for a lengthy period of time.

There are several possibilities for the temporary storage of contaminated soil from the residential area on the smelter site. The total Asarco site covers approximately 67 acres. About 40 acres are covered by structures which will be demolished in accordance with the December 1990 Demolition Record of Decision. In addition, some storage capacity exists in the fine ore bins building, which currently contains soil removed during the ERAs.

As part of the smelter facility RI/FS, and in order to fully evaluate the possibility of disposal at the Asarco facility, Asarco has prepared a containment facility siting report. This report identified potential locations within the Asarco smelter property that could be modified for use as a permanent disposal facility for excavated soil and debris. On-site containment has been evaluated primarily for the disposal of debris from stack demolition and other demolition and cleanup activities on the smelter site.

EPA and Asarco have discussed possible disposal options for excavated residential soils including disposal on the smelter site. Modifications to the preliminary designs for on-site disposal could result in additional capacity to accommodate residential soil. EPA and Asarco agree that determining the viability of this option depends to a large extent on a more specific estimate of soil and demolition debris to be removed, and upon the hazardous waste classification of the materials (residential soil and smelter site soil and debris) to be disposed. Because this classification and final volume estimates have not yet been established, it is difficult to obtain accurate detailed cost estimates for on-site disposal at this time. In addition, because the option of disposing of residential soil on-site is presently in a conceptual stage, and specific design criteria have not been established, it is difficult to make accurate predictions regarding the configuration of a disposal facility and its capacity.

4a <u>Temporary Storage and Permanent Disposal at Asarco Smelter Facility</u>

Total Estimated Present Worth Cost	$43 to $56 million
Estimated Time to Complete	7 Years

4b <u>Temporary Storage at Asarco Smelter Facility Followed by Permanent Disposal at Appropriate Off-site Facility</u>

Total Estimated Present Worth Cost	$67 to $87 million
Estimated Time to Complete	7 Years

7.6 Alternative 5 - Excavate 1 Foot of Soil/Backfill/Disposal

This alternative is identical to Alternative 4 except that excavated soil would be shipped directly off-site for disposal at a permitted landfill. The disposal options evaluated for this alternative are identical to those discussed in Alternative 3.

Significant differences between this alternative and Alternative 4 include a potential substantial increase in soil transportation distances and the elimination of an indefinite period of temporary soil storage. This alternative would incorporate the same elements of soil removal, transportation, backfilling and revegetation as described for Alternative 4.

Total Estimated Present Worth Cost	$61 to 82 million
Estimated Time to Complete	7 Years

7.7 Alternative 6 - Excavate to Depth at Which Background Contaminant Levels Are Achieved/Backfill/Disposal

This alternative is identical to Alternatives 4 and 5 except for the following - at properties or areas that exceed the action levels, excavation would proceed to a depth until background concentrations of arsenic and lead (20 ppm arsenic and 250 ppm lead) are achieved. Current data indicate that soil lead and arsenic concentrations are highly variable with depth throughout the Study Area. In addition, RI soil samples were not collected from depths greater than 16 inches, and therefore, it is not possible to accurately predict the distribution of contaminants below this depth. Additional field sampling during the remedial design phase would be necessary on a site-by-site basis to accurately define the depth of contamination prior to excavation.

Despite these limitations, estimates of the required depth of excavation were made to provide a basis for the development of this alternative. Depth profile data were not available for lead; however, the statistically significant linear correlation between lead and arsenic in surface soils provides a measure of assurance that similar trends for arsenic and lead over depth may be evident and, therefore, the arsenic profile data alone are adequate for conceptual estimates.

The conceptual excavation, design, and thus the cost estimate for this alternative, were based upon certain assumptions made in the FS regarding likely contamination levels at depth (see the FS Section 3.1.6 for further information). These assumptions represent the interpretation and application of a relatively limited set of subsurface soil data. Therefore, the assumptions and the estimates derived from the data would change and undergo refinement during the remedial design stage if Alternative 6 was selected.

The total volume of material which may require excavation and removal under this alternative is 341,000 cubic yards. Significant differences between this Alternative and Alternatives 4 and 5 include a substantial increase in the volume of soil, and the possibility of damage to some structures due to deep excavation, and the possibility that some residents may need to be relocated temporarily during excavation operations.

Relocation periods are expected to be very short, possibly no more than a few days for each resident affected and not all residents would be affected. Relocation may be necessary to ensure the safety of residents should construction activities become so extensive that the foundations of buildings are damaged or utilities services are interrupted. Other factors which may affect decisions for relocation include noise levels during remediation and limitations on access to residences. This alternative would incorporate the same elements of soil removal, transportation, and backfilling and revegetation as described for Alternatives 4 and 5.

CPMs for individual properties would generally not be required once remediation was complete since no contamination above background concentrations would remain. However, community protection measures would be required for any areas where excavation has not occurred (e.g., under roads and sidewalks and within steeply sloped areas), and where practices such as utility repair and maintenance would be conducted in unremediated areas.

Because the total volume of material to be excavated and the rate of excavation will not be determined until the design phase, it is not possible to precisely calculate the time to complete this alternative. However, based upon a 10 month work year with twenty work days per month the average remediation rate would be about four homes per month at 140 cubic yards/day using seven 35 cubic yard dump trailers per day (actual load capacity 20 cubic yards). Thus, approximately 12 years would be required to complete the soil excavation, removal and replacement at the site.

Total Estimated Present Worth Cost	$85 to 119 million
Estimated Time to Complete	12 Years

7.8 General Principles and Guidelines

The nine criteria described in Section 8.0 of this ROD are the framework that EPA used to evaluate benefits and tradeoffs among the range of FS alternatives in order to define the Preferred Alternative (described below) and to select the final remedy described in Section 9.0. Some of the balancing and modifying criteria are emphasized more than others depending on the specific conditions or problems at an individual site. Based on comments received from Study Area residents during the first public comment period, the following principles and guidelines represent features that are important to the community if a significant cleanup action is to be implemented:

(1) **Remove contaminated soil** from properties or areas which exceed EPA's action levels of 230 ppm arsenic and 500 ppm lead.

(2) **Minimize the need for long-term legal or administrative measures on individual properties** (e.g., cap maintenance requirements).

(3) **Reduce uncertainties for homeowners** by (a) sampling individual properties and (b) planning for homeowner involvement in the cleanup process.

(4) **Reduce the cleanup time frame** to the shortest duration possible.

(5) **Minimize disruption to the community during cleanup.** Schedule cleanup activities to fit within daily community routines to the extent possible. Use safety measures during cleanup to protect residents and workers.

7.9 The Preferred Alternative

The Preferred Alternative combined several elements of the alternatives described and evaluated in the FS. Below is a description of the Preferred Alternative, followed by a discussion of how it compares to the alternatives presented in the FS as discussed above.

Description of the Preferred Alternative

The Preferred Alternative calls for excavation of soils from properties or areas that exceed EPA's action levels for arsenic and lead. Excavated areas would be filled with clean soil and re-landscaped. In order to determine the specific areas requiring cleanup, each property within the area most likely to exceed action levels (see Figure 5) would be sampled. Other locations within the Study Area would be sampled as needed or as requested by the property owner. The majority of properties requiring cleanup can be cleaned completely (i.e., soil above the action levels will not remain), therefore eliminating the need for long-term controls on many private properties.

Soil which exceeds action levels below 18 inches would not be excavated. In cases where sampling shows that soil above action levels exists below 18 inches, 18 inches of contaminated soil would be removed and replaced with clean soil, and a maintenance and monitoring program for the capped area would be established. The purpose of this program would be to ensure that clean soil remains in place to cover any remaining areas where soil concentrations exceed action levels. It would also ensure that if contaminated soil is excavated in the future for development or other reasons, proper safety procedures are followed. In addition, a post-cleanup soil collection and disposal program would be established to provide a place for disposal of any remaining soil contaminated above action levels that may be excavated from beneath a clean soil cap for development or other purposes.

Excavated soil would be disposed at an appropriate facility outside of the residential Study Area. An interim staging area or transfer station, however, may be needed in the community or on the smelter site during cleanup activities.

Other elements of the Preferred Alternative include: asphalt capping of contaminated alleys and right-of-ways; development of educational materials for Study Area residents; and removal of slag driveways.

Total Estimated Present Worth Cost	$60 to 80 million
Estimated Time to Complete	7 Years

Comparison of Preferred Alternative to FS Alternatives

The element of Alternative 6 that was retained in the Preferred Alternative was the emphasis on removal of contaminated soil so that the need for long-term legal or administrative measures on individual properties after the cleanup -- including requirements for maintaining a soil cap -- can be significantly reduced throughout the Study Area. Alternative 6 provided that if all soil at depth above levels commonly found in urban areas (20 ppm arsenic) was removed, long-term measures on individual properties would not be required.

If an exemption to the State Dangerous Waste Regulations is granted (see section 7.2 a. above), long-term measures on individual properties will not be necessary if soil at a property or area above EPA's action levels (e.g., 230 ppm arsenic) is removed. Therefore, since the Preferred Alternative involves removal of soil above action levels, it provides the same benefit of Alternative 6 in terms of significantly reducing the need for long-term measures on individual properties after the cleanup, but the Preferred Alternative will not require nearly as much soil removal as Alternative 6.

Further, because the Preferred Alternative includes sampling of individual properties before a cleanup is conducted, it allows for flexibility in determining the depth to which contaminated soil would be removed. Contaminated soil would be removed only to the depth necessary as indicated by sampling. For example, if sampling shows that soil contamination above action levels exists to 6 inches below the surface, it would only be necessary to remove soil to a depth of 6 inches. Based on existing soil samples, EPA believes that the majority of properties would require excavation only within 6 inches of the surface.

The Preferred Alternative is similar to Alternatives 4 and 5 in that it includes a practicable limit on the depth of excavation at individual properties. Alternatives 4 and 5 required excavation to a depth of 1 foot at each property (Alternative 6 had no limits on the depth of excavation). The Preferred Alternative would limit excavation to a maximum depth of approximately 18 inches.

8.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

The alternatives outlined in Section 7.0 were evaluated using each of the nine evaluation criteria as required by the National Contingency Plan, and described in Table 15. The purpose of this evaluation was to identify the advantages, disadvantages, and relative tradeoffs among the alternatives. While all nine criteria are important, they are weighted differently in the decision-making process. Threshold criteria are used to determine whether an alternative meets a required level of performance. Primary balancing criteria are used to evaluate technical, economic, and practical realities, and modifying criteria require consideration of state and community concerns.

The following is a discussion of the evaluation of the nine criteria for each of the remedial alternatives. The No Action alternative does not meet the two threshold criteria and therefore is not addressed further in this section.

Threshold Criteria

8.1 Overall Protection of Human Health and the Environment

The key factor in evaluating the overall protection provided by each of the alternatives, including the Preferred Alternative, is the extent to which an individual's exposure to contaminated soil is reduced or eliminated. A general summary of EPA's range of cleanup alternatives demonstrates the varying approaches to achieving protectiveness including:

- using administrative/legal measures to prevent or minimize individual contact with contaminated soil, and to reduce risk where contact does occur (Alternative 2);
- specifying placement of a sod cover over contaminated soil to act as a barrier between an individual and the soil (Alternative 3);
- requiring removal of one foot of contaminated soil with a soil cap to isolate contaminated soil (Alternatives 4 and 5);
- requiring removal of soil from properties or areas above action levels to a maximum depth of 18 inches (the Preferred Alternative); and,
- requiring removal of soil from properties or areas above action levels to a depth at which background levels are achieved, except under structures or roadways (Alternative 6).

Each of these alternatives provides protection by either reducing exposure to contaminants or removing the contaminants, but differ in several significant respects, for example, the extent to which protectiveness can be maintained over the long-term (see Section 8.3 below). Differences among alternatives are examined under each of the remaining criteria.

8.2 Compliance with Federal and State Environmental Standards

All of the alternatives (except Alternative 2 - Limited Action) would comply with ARARs under federal or state environmental laws for the site. Table 16 lists the ARARs for the alternatives that were considered.

Alternative 2 appears to be inconsistent with both EPA's expectation and Ecology's requirement that limited action, or an action that relies solely on institutional controls such as community protection measures, should not substitute for more active measures (or a higher preference cleanup technology under MTCA) unless such active measures are found to be impractical. EPA and Ecology have determined that both (1) the physical removal of contaminated soil to a certain depth, and/or (2) the capping of contaminated soil is practicable and technically possible in the Study Area.

Requirements for an appropriate off-site facility for the disposal of contaminated soil will be described in Ecology's final decision on Asarco's petition to exempt residential soils from the Ruston and Tacoma area from disposal in a hazardous waste facility.

The requirements for hazardous waste under the Resource Conservation and Recovery Act (RCRA) are not applicable or relevant and appropriate for the Study Area cleanup because the soil and slag to be disposed are not hazardous waste.[6] Based on soil samples taken during the RI, the soil does not exhibit the toxicity characteristic under 40 C.F.R. § 261.24 or any other characteristic under 40 C.F.R. Subpart C. Slag is not regulated as a hazardous waste under 40 C.F.R. § 261.4(b)(7).

<u>Balancing Criteria</u>

8.3 Long-Term Effectiveness and Permanence

The long-term effectiveness of an alternative corresponds directly to the extent to which contaminated soil is removed under that alternative due to the potential for disturbance and re-exposure. The alternatives that rely on containment of contaminated soil and community protection measures (without soil removal) are not likely to be as effective over the long-term as removal of contaminated soil because the continued enforcement, awareness, and acceptance of such measures by government agencies and Study Area residents cannot be guaranteed.

Alternative 6 is the most effective over the long-term in terms of reducing risk to human health. The excavation of soil at depth contaminated above background levels (20 ppm arsenic and 250 ppm lead) would essentially ensure that all risks due to contact with contaminated soil above EPA's action levels would be minimized. Even under Alternative 6, however, some contaminated soil above EPA's action levels may remain under hard surfaces, such as roadways, houses, and buildings, or in steeply sloped areas.

The Preferred Alternative offers the next most comprehensive level of long-term protection because it would cleanup, to a maximum depth of 18 inches, most of the properties or areas that exceed action levels. A clean cover of soil would be installed, and cap maintenance measures would be established, where soils over the action levels are left below the cover. Based on current depth profile sampling data (to a depth of 16-inches), EPA estimates that only a small percentage of properties would have contamination remaining below 18 inches.

Alternatives 4 and 5 are the next most effective over the long-term because they would require excavation of soil to a depth of 12 inches at properties or areas that exceed EPA's action levels. A clean cover of 12-inches of soil would be installed and cap maintenance measures would be established where soils over the action levels are left below the cover.

The Preferred Alternative and Alternatives 3, 4 and 5 also call for a soil testing, removal and collection program for the Ruston/North Tacoma residents if soil areas above EPA's action levels need

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[6] Under Washington state's Dangerous Waste Regulations (Chapter 173-303 WAC), removed soil or slag with arsenic concentrations greater than 100 ppm is considered dangerous waste (see Section 7.2.a for information on the petition for exemption from the Dangerous Waste Regulations).

to be excavated after the cap is in place, for example during remodeling activities that require excavation of soil below the cap.

Alternative 3 is less effective than 4, 5, 6 and the Preferred Alternative because it involves very little removal of contaminated soil. Typical use of a yard could penetrate or degrade the sod barrier, exposing contaminated soil. Alternative 3 is more protective over the long-term than Alternative 2, however, because placing a new sod barrier would reduce potential exposure to contaminated soil at least to some extent.

Alternative 2 would provide the least protection over the long-term because it would not provide for either a comprehensive removal of contaminated soil or a physical barrier against contaminated soil. Its success would depend upon the sustained acceptance, understanding, and participation of the community in the community protection measures programs. Alternative 2 also provides for a soil disposal program for individual disturbances of contaminated soil.

8.4 Reduction of Toxicity, Mobility, or Volume through Treatment

None of the alternatives provide for treatment of contaminated soil. Although soil washing was considered the most viable treatment alternative for the Ruston/North Tacoma soils, it was determined that further consideration of soil washing was not justified based on the results of a "Treatability Study" (Fractionation and Soil Washing of Ruston/North Tacoma Soils, EPA, November 1991). The study showed that soil washing was not consistently effective at reducing the concentrations of contaminants to protective levels.

8.5 Short-Term Effectiveness

The potential for short-term risks and exposures, e.g., inhalation of contaminants by workers or residents because of dust and particles generated by movement of soil, and increased traffic in the community, are directly related to the extent of soil excavation required by each of the alternatives, including the Preferred Alternative. Alternative 6 would potentially present the most significant short-term exposures because more extensive soil removal would be required than under any other alternative. Short-term risks are potentially less of a problem under Alternatives 2 and 3 because extensive soil removal is not required.

Short term risks and exposures can be minimized because dust control and safety measures, including air monitoring, would be required during excavation. Also truck beds would be lined and covered when transporting contaminated materials, truck wheels would be cleaned before travelling on public roads, and local truck routes would be established to minimize disruption to the community. The Preferred Alternative would require that local roads used for transporting contaminated soils be regularly inspected and repaired if damage occurs due to improper use when implementing the remedy. In addition, trucks would be expected to use common safety precautions (e.g., brake inspections). Also, rail transportation of contaminated soil may be an acceptable alternative to trucks.

An analysis of short-term effectiveness includes an evaluation of the time necessary to complete cleanup activities under an alternative. Although short term risks to the community under Alternative 2 would be low, the community protection measures program under this alternative would be ongoing indefinitely throughout the entire community.[7] Alternative 3 would involve both minimal short-term risks because extensive soil excavation is not required, and because of the relatively short time frame to complete its activities - perhaps 1 year to complete sodding replacement activities.

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[7] Some form of community protection measures program would be necessary for all of the alternatives. Since the primary purpose of the program is to address contaminated soils that remain in the community after the cleanup, the scope and duration of the program will be more substantial when less soil is removed from the Study Area.

Alternatives 4, 5, and the Preferred Alternative are generally similar in terms of their short-term effectiveness, although the Preferred Alternative may be advantageous because it allows for varying depths of excavation based on soil depth profiles (Alternatives 4 and 5 require that all contaminated soils be removed to a 12 inch depth). Short-term risks and exposures are potentially greater for Alternative 6 because removal of more soil increases the possibility for damaging utilities and other structures. Also, Alternative 6 may require almost twice as much time to complete as Alternatives 4, 5, or the Preferred Alternative.

8.6 Implementability

All alternatives are technically feasible. Alternative 3 is the easiest physical cleanup to implement, requiring only replacement of sod. Alternatives 4, 5, 6 and the Preferred Alternative require the extensive removal and replacement of soil as well as sod.

The excavation, soil replacement, and sodding activities performed under Alternatives 3 through 6 and the Preferred Alternative are common practices and do not limit the implementability of these alternatives. Access to private properties would be required for Alternatives 3 through 6 and the Preferred Alternative. Off-site disposal facilities are available for Alternatives 3, 5, 6 and the Preferred Alternative. The availability of disposal services on the Asarco smelter facility under Alternative 4, however, will not be determined until the cleanup action for the smelter is selected (see Section 7.5).

Each alternative involves the use of community protection measures to varying degrees. The development, implementation, and enforcement of these measures would require extensive coordination with other agencies and private parties. Under Alternatives 2 and 3, community-wide acceptance of and compliance with community protection measures may be difficult to maintain over a long period of time. Fewer community protection measures would be required as part of either the Preferred Alternative or Alternatives 4, 5, and 6 due to the removal of the majority of contaminated soil.

8.7 Cost

The total cost of the alternatives is summarized in Table 17. These costs are estimated for the purpose of comparison and are considered to be accurate within -30 to +50 percent. The estimates are based on the estimated areas exceeding action levels (273 acres shown in Figure 5). The alternatives, except for 4a, assume final disposal of contaminated soil at a facility outside of the residential area. Alternative 4a assumes disposal of soil on the smelter site.

The incremental cost associated with the alternatives involving soil removal compared to the alternatives that do not remove soil is reasonable and proportionate to the increased effectiveness over the long-term of the soil removal alternatives (also see the discussion of cost-effectiveness in Section 10.3 below). Moreover, the estimated cost of the Preferred Alternative is well within the range of estimated costs for Alternatives 4 through 6.

<u>Modifying Criteria</u>

8.8 State Acceptance

Ecology agrees that "the long-term effectiveness of an alternative corresponds directly to the extent to which contaminated soil is removed." Ecology believes that the engineering action levels selected represent a best balance of the factors related to this site. Ecology further believes that the residual risks can be adequately addressed through CPMs. Ecology emphasizes that this decision on engineering action levels is specific for the factors related to this site only. Accordingly, Ecology concurs with the EPA preferred alternative and the remedy selected in this ROD.

8.9 Community Acceptance

Community acceptance is an important consideration in the selection of a cleanup remedy for the Ruston/North Tacoma Study Area. Generally, community concerns about the site have centered around the significance of the potential health threat from the contaminated soils, the stigma associated with living at a Superfund site, and the resulting economic impacts. Some citizens have questioned whether the risk warrants a cleanup, while others have stated that they would prefer EPA to err on the side of protectiveness. Because the estimated risks do warrant cleanup, and acceptance of cleanup measures by the community is important to successful implementation of the remedy, EPA implemented a significant community involvement plan throughout the RI/FS activities.

The goal of the community involvement plan was to provide opportunities for the community to actively participate in developing the remedy. The community became involved in a variety of ways including: the Ruston/North Tacoma Coordinating Forum and Community Workgroup; regular community meetings (open houses, workshops, public meetings); and by commenting during two 60-day public comment periods held during the RI/FS and Proposed Plan processes. (A more detailed description of community involvement activities can be found in Section 3).

During the first of two public comment periods (February - April 1992) EPA requested public comments on the six alternatives evaluated in the FS. EPA used the comments received to develop the Preferred Alternative which was outlined in the Proposed Plan. Public comments were submitted on a variety of subjects including: health concerns; property values; soil sampling and disposal; community protection measures; cleanup levels; and the length of time to complete a cleanup. A summary of the comments received during the first comment period and EPA's responses is included in section (F) of the Proposed Plan.

The Preferred Alternative (described in the Proposed Plan) consisted of elements from five of the six alternatives described and evaluated in the FS. For the Preferred Alternative, EPA selected elements that were protective of human health and the environment, and those that commenters recommended. The Proposed Plan including the Preferred Alternative was the subject of the second public comment period (August - October 1992).

Specific comments on the Proposed Plan included comments pertaining to: homeowner involvement in the cleanup; expanding the cleanup area; the depth of soil excavation; paving of dirt roads; the overall protectiveness of the plan; and support of the plan. See the Responsiveness Summary included as Appendix A of this ROD for a detailed summary of public comments from both comment periods, and EPA's responses.

In general some community members still do not believe that cleanup of arsenic and lead contaminated soils in the Study Area is necessary. Other commenters, however, felt that if EPA must require a cleanup, the Preferred Alternative addressed many of their concerns. In addition, some community members commented that a cleanup was necessary and should be implemented. Some felt that soil should be cleaned-up to reduce the potential health risks, while others thought a cleanup would eliminate the "stigma" that they feel EPA's Superfund activities have created in the community.

One common theme contained in most of the comments was the need for input from the homeowners. Commenters felt that a homeowner should have a say in what happens on their property and not be subject to, or pay for, actions they didn't want.

Although there is not a consensus within the community on whether cleanup actions should be taken, by involving the public in developing the cleanup plan, and by addressing many community concerns in the Preferred Alternative and the Selected Remedy, a remedy has been selected that will be acceptable to many members of the community.

EPA will continue to implement community involvement activities throughout the cleanup to ensure that homeowners and other interested citizens continue to be involved. These efforts will include working individually with homeowners before, during and after cleanup to make sure the work is done properly and to their satisfaction.

9.0 THE SELECTED REMEDY

EPA has selected the Preferred Alternative, as modified by public comments, as the remedy for contaminated soil in the Ruston/North Tacoma Study Area. This remedy addresses soil in residential, commercial, and public areas, vacant lots, parking strips, landscaped areas, garden areas, unpaved driveways, and roadway shoulders. In addition, this remedy addresses slag used in driveways and other areas where slag use could lead to potential human exposure.

The remedy employs both engineering and community protection measures to reduce exposure of current and future residents to contaminated soil and dust, and to reduce the potential transport of soil contaminants inside homes or buildings where exposures may occur. Following are the individual components of EPA's Selected Remedy.

9.1 Sampling

The following approach will be used to determine the individual properties or areas at which a cleanup will take place (i.e., those properties or areas, including significant areas within individual properties, that exceed action levels):

(a) Surface and depth samples will be taken at all properties within the shaded area in Figure 5 (i.e., the area where properties are most likely to exceed action levels). Depth samples will be taken in order to determine the extent of contamination and the level of excavation required. In addition, all schools, parks, and playgrounds within the Study Area will be inventoried and sampled.

(b) Additional samples will be taken in areas outside the shaded area, including the three properties immediately outside the Study Area, where concentrations in excess of action levels were detected.

(c) Samples will also be taken at properties outside of the shaded area but within the Study Area as needed to supplement the RI sampling results or at the request of property owners. If a sampled property or area is identified as exceeding action levels, sampling will also be conducted at contiguous properties.

(d) EPA will provide sample results to homeowners in the Study Area and indicate whether a cleanup is or is not necessary.

(e) EPA will evaluate the need for further sampling (and appropriate cleanup activities) outside the Study Area separate from the final cleanup action for the Study Area (see Section 4.1 of this ROD for additional information).

(f) The current data base of sampling results will be expanded to store the results for all of the properties that are sampled (see Section 9.10 below).

9.2 Small Quantity Soil Disposal Program

A soil collection and disposal program will be conducted for owners of properties requiring cleanup (i.e., properties where sample results exceed action levels) that generate small quantities of soil **prior to** the final cleanup of their property (see Section 9.10 (b) below on post-cleanup soil collection service).

9.3 Excavation of Contaminated Soil, Sod, and Slag

At properties or areas where soil exceeds action levels (230 ppm arsenic and 500 ppm lead)[8], soil and sod will be excavated. Slag driveways within the Study Area (as well as other uses of slag where small particles could be ingested) will be excavated and replaced with gravel. Large pieces of ornamental slag, e.g., slag used in retaining walls or as a landscaping feature, will not be removed.

(a) Removal activities generally will address sod areas (residential, public, and commercial), landscaped areas, garden areas, unpaved driveways, and roadway shoulders. Removal activities, in general, will not address soil within residential areas that is covered by an existing structure or hard surface, e.g., concrete pads, patios, sidewalks, driveways, crawl spaces, wooden decks, and dirt basements and garages. When these conditions are encountered within a residential yard, flexibility will be employed in making cleanup determinations by considering the following factors: (1) the potential for exposure; (2) the feasibility of conducting the cleanup; and (3) contaminant concentrations in other parts of the yard (i.e., as an indication of possible concentrations in covered areas).

(b) The depth of excavation at individual properties will depend on the depth of contamination shown by sampling results, but will not in general exceed a maximum depth of 18 inches. Flexibility will be used in making cleanup determinations in those areas where contamination may extend just slightly below 18 inches.

(c) Samples will be taken after excavation to confirm that contaminated soil from properties or areas that exceed action levels has been removed.

(d) Excavated soil and sod will be replaced with "clean" soil and sod, i.e., soil with concentrations of arsenic and lead that do not exceed concentrations commonly found in local urban areas - 20 ppm arsenic and 250 ppm lead. Even lower values for the replacement soils, especially for lead, are likely achievable, e.g., lead less than 100 ppm. Vegetation will be replaced. Slag will be replaced with gravel.

(e) It may be necessary to establish a temporary staging area or transfer facility for excavated soil within or near the Study Area, potentially including on the Asarco smelter site. The transfer of materials may be required because many streets throughout the Study Area cannot be easily accessed by the larger vehicles that will be used to transport removed soils to the disposal location. The staging area or transfer station is not meant, however, to serve as a long term storage facility.

9.4 Properties or Areas Where Soil Above Action Levels Remains

If areas above action levels remain below 18 inches, the replacement soil will serve as a cap or barrier to the remaining contaminated soil. Vegetation will be replaced.

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[8] Based on comments received during the Proposed Plan public comment period, there is some misunderstanding regarding the cleanup of properties contaminated solely by lead. It is possible that some exceedances of 500 ppm soil lead may occur in the Study Area unrelated to releases from the Asarco smelter. Under this remedial action, EPA will take or compel remedial actions at the site that address current contamination from smelter operations and releases, but not similar contamination resulting from other sources, such as lead-based paints or automotive emissions, that are widespread. The Superfund law limits the extent to which EPA can address releases from these other sources (see CERCLA § 101(22) and § 104(a)(3), 42 U.S.C. §§ 9601(22) and 9604(a)(3)). Some property-specific determinations may be required to decide on the inclusion or exclusion of such areas as part of site remediation.

(a) A "marker," e.g., a geotextile fabric or geocomposite material, will be used to clearly identify the base of the cap for future intrusions.

(b) Community protection measures, described below in Section 9.10, will apply to the capped areas.

9.5 Dirt Alleys and Parking Areas

Dirt alleys and parking areas with soil that exceeds action levels will either be capped with asphalt to provide an impermeable barrier to contaminants, or the contaminated soil will be removed and replaced with clean gravel. A determination regarding the appropriate option will be made based on consideration of the sampling results and the extent of contamination, the relative cost effectiveness of the options given the area to be remediated, and consultations with the local municipalities.

9.6 Fencing

Soil in areas which are too steeply sloped to be excavated will be fenced and planted with low lying shrubs (see Figure 6). A geotextile material will be applied to the soil to provide erosion protection, as well as a means for supporting vegetative development.

9.7 Cleanup Timeframe, Schedule and Prioritization

The cleanup of properties will generally proceed within an area at a time, beginning with the most highly contaminated areas. The Study Area will be divided into manageable zones. To the extent possible, within an area or zone, priority may be given to schools, parks, playgrounds, daycares, homes with children, or other areas where children tend to gather. EPA believes that this is not only the most efficient method for cleaning up properties, but that this strategy will be the least disruptive to the community overall.

Attempts will be made to shorten the estimated 7 year cleanup timeframe as much as possible by using the maximum amount of trucks, crews, etc., that are available and that the community is willing to tolerate. Community input will continue to be sought as the cleanup progresses and zones are established and individual lots scheduled for cleanup actions (see Section 9.16 below).

9.8 Information for Deed Notice

If requested by an owner of property, a factual description of the sampling results and/or the cleanup that has been completed at that property will be provided. Owners may want to use this information for the purpose of a deed notice to show that the property did not require cleanup actions, or that cleanup actions were completed on the property.

9.9 Safety Measures

During implementation of the cleanup, safety measures will include, at a minimum, air monitoring, the use of dust suppression techniques during excavation activities, covering of any stockpiled materials, lining and covering truck beds when transporting contaminated materials, removing soils from truck wheels before trucks travel on public roads, and the establishment of a transportation plan to establish local truck routes to minimize disruption to the community.

9.10 Community Protection Measures

The CPMs program for the Study Area included in this ROD addresses: (1) areas where complete removal of soils above the action levels is not practicable, e.g., areas where contamination above the action levels is to be left at depths greater than 18 inches or may be detected in the future under roadways, sidewalks or buildings; as well as (2) areas where soil arsenic levels exceed concentrations normally found in urban areas, but are below the action levels and therefore would not require cleanup. The appropriate CPMs for soils in the second category include educational measures on how to minimize contact with contaminated soil, measures to take if contact does occur, how to dispose of soils in an environmentally safe manner, and the components listed under (d), (e), and (f) in this section below. The appropriate CPMs for soils in the first category are discussed further below.

EPA believes that the measures outlined in this Section, at a minimum, are the most effective way to implement the CPMs program. Specific details for the program will be finalized during the design phase of the cleanup.

A full time person from the TPCHD will be funded to serve as the CPMs program coordinator. The coordinator will be responsible for developing and carrying out the program elements described below, and for coordinating the development, implementation, and evaluation of the CPMs program with a workgroup[9] and the Community Relations Program coordinator (described below in Section 9.16). The CPMs program will include, at a minimum, the following elements:

(a) Measures to control soil disturbances.

Guidelines and safety procedures will be developed for conducting excavations so that contact with remaining contaminated soil is minimized, and that such soil is appropriately disposed. The guidelines will address the following areas: (1) significant development projects; (2) soil disturbance activities conducted by homeowners or citizens; and (3) utilities maintenance projects.

The guidelines for conducting significant development projects will be dispensed with permits issued in Ruston and Tacoma.

The information for homeowners will address any special considerations identified, e.g., children, parents, and eating garden vegetables. Day cares will be identified as a specific audience for receiving educational material. In addition, educational material will be developed for distribution in the schools.

The CPMs program coordinator will work directly with Ruston and Tacoma to identify specific departments conducting utility maintenance activities. Educational materials, including appropriate distribution methods, will be developed to address the needs of the identified departments.

(b) Soil testing, collection, and disposal program.

A soil testing, collection, and disposal program will be developed to apply when soil above the action levels is excavated from beneath a cap or other area where contamination remains, including from existing ERA sites (see Section 9.12 below). The program will be available for contaminated soil that is excavated as a result of small scale homeowner activities, development projects, and City or

[9] As part of the proposed conditional exemption for arsenic contaminated soils in the Ruston/ North Tacoma Study Area, Ecology will require an ongoing education program to inform residents about appropriate measures to minimize residual risk from contaminated soils, and the proper management of these soils. To meet the requirements for coordinating the education program with local and state government, staff conducting the program will work with a workgroup to set goals for the education program and provide input from the community on education measures. The workgroup will include representatives from the Town of Ruston, the City of Tacoma, TPCHD, EPA and Ecology, as well as residents of the Study Area, members of the business community, parents, students, school personnel, and other interested citizens. The workgroup will provide guidance in the development and implementation of the education program.

Town maintenance projects. Transportation of excavated material to the disposal facility will be provided. A component of this program will address the development and distribution of information on the availability and use of this program.

(c) Measures to maintain the integrity of caps.

A maintenance and monitoring program will be established to ensure the continued integrity of soil, sod and asphalt caps, including visual inspections of capped areas. Maintenance activities will include repair of damages to, or failures of, caps that are caused by improper placement, e.g., insufficient drainage measures.

Homeowners will generally be responsible for maintaining and repairing established caps in individual yards as part of the normal upkeep of private property. The City and Town will be responsible for general cap maintenance and repair activities on public access areas and roadways, but not for damage as a result of remediation activities or as a result of a failure of the remedy.

(d) Development of a property specific data base.

Information regarding sample results and cleanup activities at individual properties will be consolidated into a data base. The data base will be easily accessed, frequently updated, and centrally located and maintained. The data base will be available to interested individuals (e.g., property owners) in Ruston and Tacoma. Efforts will be made to determine the best ways to inform people about the existence of the data base, as well as additional parties that need to be made aware of its existence, e.g., real estate personnel.

(e) Notification to future property owners.

The data base will provide information to current and future property owners regarding (1) sample results, (2) completed cleanup efforts, and (3) cap maintenance responsibilities for properties or areas where contamination remains above the action levels. The real estate and lending communities will be informed about the data base to ensure that information necessary for property transfers is readily available.

(f) Evaluations of the effectiveness of the CPMs program.

A yearly progress report will be prepared regarding activities and educational measures conducted under the CPMs program. The workgroup, identified above, together with an independent entity identified by the workgroup, will be responsible for reviewing the report, evaluating the adequacy of the CPMs program, and suggesting any necessary changes.

9.11 Funding

As part of the remedy, a funding mechanism will be established under EPA, state or local direction or oversight to provide resources to implement the selected remedy including ongoing educational measures and the community protection measures program.

9.12 Expedited Response Action Properties

In 1990, 1991, and 1992 under an Administrative Order on Consent with EPA, Asarco conducted cleanup actions at 10 publicly accessible areas (and portions of an 11th area) where soil exceeded 250 ppm arsenic. The top 3 inches of soil was removed and replaced with a 9 to 12 inch soil cap. Access agreements between Asarco and the property owners were established that included provisions for the care, maintenance and monitoring of the soil and vegetation caps. These agreements were designed to be effective until the completion of the Ruston/North Tacoma RI/FS and the issuance of this ROD. As part of the RI/FS, EPA evaluated the ERA sites to determine whether the ERA was an effective permanent remedy.

The Selected Remedy is similar to the ERA activities in that they both involve the removal and replacement of contaminated soil, and provisions for the care, maintenance and monitoring of soil caps. Under the Selected Remedy, the ERA properties will be sampled to a depth of approximately 18 inches from the surface of the cap. If contaminated soil is found, the ERA property will be included in the community protection measures program (see Section 9.10) outlined in this ROD. Given that this effort provides for the continued care, maintenance and monitoring of ERA site soil caps, further remediation of ERA sites is not necessary.

The portions of Site 8 of the ERA properties that have not yet been remediated will be cleaned up in accordance with the Selected Remedy under this ROD.

9.13 Disposal

Current state regulations require disposal of removed soil with arsenic concentrations above 100 ppm at a hazardous waste facility (Dangerous Waste Regulations, 173-303-141 WAC). The nearest such facility is located in Arlington, Oregon. Asarco has submitted a petition to Ecology requesting an exemption from the requirements of these regulations. Ecology has evaluated the petition and has proposed to conditionally exempt both soil with arsenic concentrations less than 230 ppm, and soils with arsenic concentration greater than 230 ppm from the disposal criteria required in the regulation.

Where soils with arsenic levels at or below the 230 ppm action level are excavated, educational measures will be provided on how to minimize contact with and dispose of these soils in an environmentally safe manner. For soils with arsenic concentrations over the 230 ppm action level, specific disposal facility criteria have been proposed. The proposed conditions of the exemption are described in Table 16. These conditions, when finalized, will be requirements for the Selected Remedy.

Based on the current information regarding disposal as described in the paragraph above, EPA has selected disposal at an appropriate off-site facility for the Selected Remedy. If the dangerous waste exemption is approved, however, other possible disposal locations for Study Area soil may become available in the future. For example, there are other non-hazardous waste landfills in the state which might meet the exemption requirements. In addition, before EPA selects a cleanup remedy for contaminated soil and ground water at the Asarco smelter site, EPA expects to consider a range of cleanup alternatives that may include consolidation of contaminated soil on the smelter site, treatment of contaminated soil and ground water, capping of contaminated soil, and excavation and off-site disposal of contaminated soil. It is possible that if EPA decides to select on-site disposal, capacity may be available for Study Area soil. EPA notes, however, that its decision on the cleanup of the Study Area is separate and apart from its decision on the cleanup of the smelter site. The selection of a cleanup remedy for the Asarco smelter site will be subject to further public review and comment.

9.14 Homeowner Access and Approval

Cleanup activities will be coordinated with homeowners to define the extent of work to be performed on individual properties. The following activities will take place prior to any soil removal activities on an individual property:

(a) Work with property owners to obtain access for sampling and conducting the remedy.

(b) Conduct site survey, photograph or videotape properties, and prepare detailed plan for each property. Verify stability of structures on the property, including foundations, with respect to anticipated depth of excavation (also see Section 9.17 below).

(c) Schedule the work with the homeowner.

9.15 Landscaping

The actual vegetation removal and replacement plan will be determined on a property-by-property basis to accommodate both the project needs and property owners to the extent that is reasonably possible. Reasonable attempts, which do not hinder the progress of the remediation and are not excessively costly, will be made to accommodate owners who desire to retain original landscaping.

9.16 Community Relations During Cleanup

A community relations program, including a full time coordinator, will be established to provide coordination and communication between cleanup personnel, residents, and property owners. The community relations program coordinator will work together with the coordinator and workgroup identified under the community protection measures program above (Section 9.10) to address the needs of the community including residents, businesses and schools. This program will include the following elements at a minimum:

(a) Establishment of a local information center within the community where information regarding cleanup activities and schedules could be obtained.

(b) Coordination and communication of cleanup schedules with property owners, including discussions with property owners and day care operators regarding the appearance of the community during cleanup activities, and any recommended safeguards or precautions.

(c) Notification to residences, businesses, and schools prior to the start of remediation efforts.

(d) Preparation and distribution of regular project updates to businesses, residents, and schools, and the identification of additional ways of keeping people informed about cleanup activities and progress.

(e) Regularly scheduled community meetings to discuss cleanup schedules and processes, and to address questions and concerns regarding cleanup activities.

9.17 Incidental Damage During Remediation

All possible precautions will be taken during remediation to avoid damage to property. It is possible, however, that the excavation of soil from properties, and the use of heavy equipment for remediation and transportation activities, may result in damage to some underground utilities, sprinkler systems, fences, foundations, yard lighting, roads, sidewalks, etc. Efforts will be made to anticipate and minimize these possible problems by working with the homeowners, municipalities, and utilities to prepare sketches of each property to identify all known underground items.

In addition, all properties including roads and sidewalks will be surveyed and inspected prior to remediation activities to establish existing conditions. Items damaged as a result of remediation activities will be repaired or replaced where feasible. As part of the replacement of clean soil on individual properties, efforts will be made to ensure adequacy of drainage and erosion control.

9.18 Cost of the Selected Remedy

EPA estimates a range of $60 to $80 million total present worth costs to conduct the Selected Remedy. The lower cost reflects the disposal of contaminated soil at a non-hazardous waste disposal facility (see Section 9.13 above) and the higher cost indicates disposal at an out-of-state hazardous waste facility. See Section 8.7 for more information on cost estimates and comparisons.

10.0 STATUTORY DETERMINATIONS

10.1 Protection of Human Health and the Environment

The selected remedy will eliminate, reduce, or control exposure to contaminants at properties or areas that exceed action levels for arsenic and lead as a result of emissions from the smelter. Risks from exposure to soil that exceeds the action levels will be eliminated by removing contaminated soil and disposing it elsewhere. Where soil removal is impracticable, e.g., where areas above action levels extend below 18 inches in depth, the risk will be controlled by placing a cap of clean soil and sod above the contaminated area to act as a barrier to direct contact exposure.

The goal of CPMs is to ensure that the remedy remains protective over the long-term. The objectives of CPMs include: monitoring the condition of the caps; informing homeowners - current and future - that residual contaminated areas exist on certain properties (or may exist in certain areas, e.g., below structures or roadways); and educating residents on minimizing exposure to contaminated areas, managing and disposing of soil if contaminated areas are excavated, and reducing exposure to concentrations that are below action levels but above levels that are commonly found in urban areas.

Short-term risks to the community during implementation of the cleanup action will be minimized through dust control and other protective measures.

10.2 Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedy will attain ARARs under federal and state law (see Table 16).

10.3 Cost-Effectiveness

The cost of the Selected Remedy is proportional to its overall effectiveness and it represents a reasonable value for the money to be spent under NCP section 300.430(f)(1)(D). In determining this "proportionality," EPA compared the differences in cost and effectiveness between the two primary cleanup approaches under consideration for the Study Area: (1) removing from the Study Area as much soil that exceeds the action levels as feasible, replacing the removed soil with clean soil, and disposing the contaminated soil elsewhere (the Selected Remedy); versus (2) leaving the contaminated soil or dirt in place and covering it with sod or asphalt (Alternative 3 in the Feasibility Study). The difference in cost is justified based on the difference in effectiveness over the long-term between the two approaches.

The significant advantage to the more costly soil removal and replacement approach is that it permanently removes the majority of soil exceeding action levels, and therefore significantly reduces the need for community protection measures on many individual properties. The owner and residents of a property where soil contamination above action levels has been removed and replaced with clean soil will be able to enjoy the use of the property without undue restriction. Where it is not practicable to remove all contaminated soil, e.g., where soil above the action levels remains below 18 inches from the surface, the cleanup approach will rely on a cover of sod and 18 inches of clean soil to prevent exposure to the contamination. Soil caps will be necessary only at a limited number of properties.

The primary disadvantage to placing only a thin sod cover over existing contaminated soil is that supplemental measures will always be required to ensure that the sod cover continues to provide protection against the contamination. Sod covers can fail as a result of several types of disturbing activities, thus exposing residents to contaminated soil. Such disturbing activities, which reasonably could occur at many properties, include changes in structures on a property (e.g., adding a deck, tearing down a toolshed), loss of vegetative cover from imposition of lawn watering restrictions, or establishing or relocating a garden or children's play area.

The soil cap that would be used under the Selected Remedy where contaminated soil remains would not be as easily penetrated or degraded by human activities or dry conditions because of its thickness. Failures of sod covers are much more likely than failures of a sod-covered 18 inch soil cap, i.e., the protectiveness and long-term effectiveness of a cap increases as the thickness of the cap increases.[10]

In comparing the cost-effectiveness of the two cleanup approaches, EPA reevaluated the community protection measures components under both Alternative 3, as described in the FS, and the Preferred Alternative, as described in the Proposed Plan. More comprehensive long-term monitoring, maintenance, and repair measures for the sod covers as well as an enhanced soil collection service, especially for Alternative 3, would be necessary for an effective long-term cleanup. Such measures would make Alternative 3 nearly as effective as the Selected Remedy in preventing or reducing exposure to contaminated soil. Alternative 3 would not be as effective over the long-term as the Selected Remedy because of the impossibility of ensuring complete compliance with the maintenance, monitoring, and repair requirements at over 500 properties estimated by EPA to have soil exeeding the action levels.

In order to prevent failure of sod covers, they would have to be monitored on a regular basis and repaired when necessary. Also, an extensive program would have to be developed to ensure that "all" current and future homeowners and residents are fully aware of the need to maintain the cover in order to avoid exposure to contaminated soil. Further, the soil collection, testing, and disposal program would have to be substantially more intrusive and encompassing than under the Selected Remedy. This measure would be required in order to accommodate the contaminated soil that would not be removed during EPA's cleanup, but which may be excavated in the future as the result of some of the activities described above.

Because additional measures would need to be added to Alternative 3 to increase its protectiveness over the long-term, EPA has re-estimated the cost of Alternative 3 with such measures. The estimated cost of Alternative 3 in the FS was $24 million, which has been increased for a revised Alternative 3 to $36 million (non hazardous disposal). See Bechtel Memorandum dated May 1993 entitled "Revised Cost Estimates for the Selected Remedy and Alternative 3 at Ruston/North Tacoma Washington. Based on this reanalysis of the cost of long-term measures, which are necessary to a much less extent for the Selected Remedy, EPA's estimate of $60 million for the Preferred Alternative (nonhazardous disposal) has been revised to $62 million for the Selected Remedy.[11]

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[10] It should be noted that it does not appear practicable to use soil and sod covers without removing soil -- i.e., adding up to 18 inches of soil without removing an equivalent amount of soil first would seriously impact grading and drainage patterns.

[11] EPA has not reevaluated the cost of every other alternative in the FS because determining whether the Selected Remedy was cost-effective required only a comparison of the two distinct strategies to the cleanup -- removing contaminated soil versus leaving contaminated soil in place with a sod cover.

Alternatives 4 and 5 as described in the FS varied the disposal locations for the contaminated soil. The estimated cost of the Selected Remedy is based on disposal of removed soil in either the hazardous or nonhazardous facilities in Arlington, Oregon. Although this ROD selects appropriate off-site disposal, it does not preclude other disposal options that may become available in the future, including disposal on the smelter site (e.g., removed soil could be used as a subbase for capping or disposed in an on-site disposal facility).

Despite the significantly increased estimate of cost for Alternative 3, the continued effectiveness of such programs for hundreds of properties over many years would be problematic because the continued enforcement, awareness, and acceptance of such controls cannot be guaranteed. Moreover, the continual intrusiveness of such programs into an owner's use of his/her property may be substantial.

There is an advantage in the effectiveness over the long-term of a cleanup that removes most of the contaminated soil, as opposed to a cleanup that uses sod covers to contain contaminated soil. This advantage is well worth the incremental difference in cost - $62 versus $36 million - between the two approaches. Accordingly, the cost of the Selected Remedy is proportional to its effectiveness and is, therefore, cost-effective under CERCLA and the NCP.

10.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy is permanent to the maximum extent practicable because it requires removal from the Study Area of most of the soil contaminated above action levels. Removal of soil from properties or areas that exceed action levels significantly reduces the risk to residents of the Study Area. Soil removal "to the maximum extent practicable" is defined for purposes of the Study Area as properties or areas that exceed action levels down to 18 inches below the surface. This maximum extent practicable determination is based on the infeasibility of excavating and disposing of soil from below 18 inches in depth together with the effectiveness of soil caps to control exposure to contaminated soil below 18 inches.

The selected remedy represents the best balance of tradeoffs among the alternatives considered in the FS and Proposed Plan. The primary criterion relied upon in making this determination is "long-term effectiveness and permanence," which is analyzed above as part of the "protectiveness" and "cost-effectiveness" determinations. Also of significance in making this maximum extent practicable determination are comments received from the community. Among the residents in favor of a cleanup, most favor the cleanup approach that physically removes contaminated soil from the Ruston/North Tacoma Study Area.

As explained on pages 2-60 through 2-69 of the FS, and in the introduction to Section 7.0 of this ROD, active treatment measures are not practicable to address the large volumes of contaminated soil within the Study Area.

10.5 Preference for Treatment as a Principal Element

As explained in Section 10.4 above, the selected remedy will not satisfy the preference for treatment.

11.0 DOCUMENTATION OF SIGNIFICANT CHANGES

During the public comment period on the Proposed Plan, EPA received comments from Asarco regarding the asphalt paving of dirt alleys and parking areas where soil exceeds the action levels. Asarco commented that compared with asphalt capping, removal of contaminated soils from alleys and parking areas followed by replacement with clean gravel would be a superior alternative.

Since any options associated with disposal of Study Area soils on the smelter property can only be implemented if determined to be appropriate under the smelter cleanup, which is not expected to begin for several years, this cost-effectiveness analysis for the Study Area cleanup does not consider the cost of the smelter options. If such options are approved and implemented, however, EPA expects that the cost of the Selected Remedy may be reduced as disposal costs would be lower.

Asarco also suggested that the removal and gravel replacement option would be more cost effective than asphalt capping, and would also provide a more permanent solution.

EPA has reevaluated the Proposed Plan requirement for asphalt paving of dirt alleys and parking areas exceeding the action levels. The two approaches are similar in terms of their overall protectiveness. The primary difference between the two approaches is the need for long term maintenance of asphalt caps that are underlain by contaminated soils. The frequency of intrusions to the asphalt caps, however, would be less than those in residential lawn areas.

Accordingly, Section 9.5 of this ROD allows for dirt alleys and dirt parking areas that exceed action levels to be either capped with asphalt to provide an impermeable barrier to contaminants, or for the contaminated soil to be removed and replaced with clean gravel. A determination regarding the appropriate option will be made based on consideration of the following factors: (1) the sampling results and the extent (depth) of contamination; (2) the relative cost effectiveness of the options given the area (size) to be remediated; and (3) consultations with the local municipalities.

FIGURES

Ruston/North Tacoma Study Area

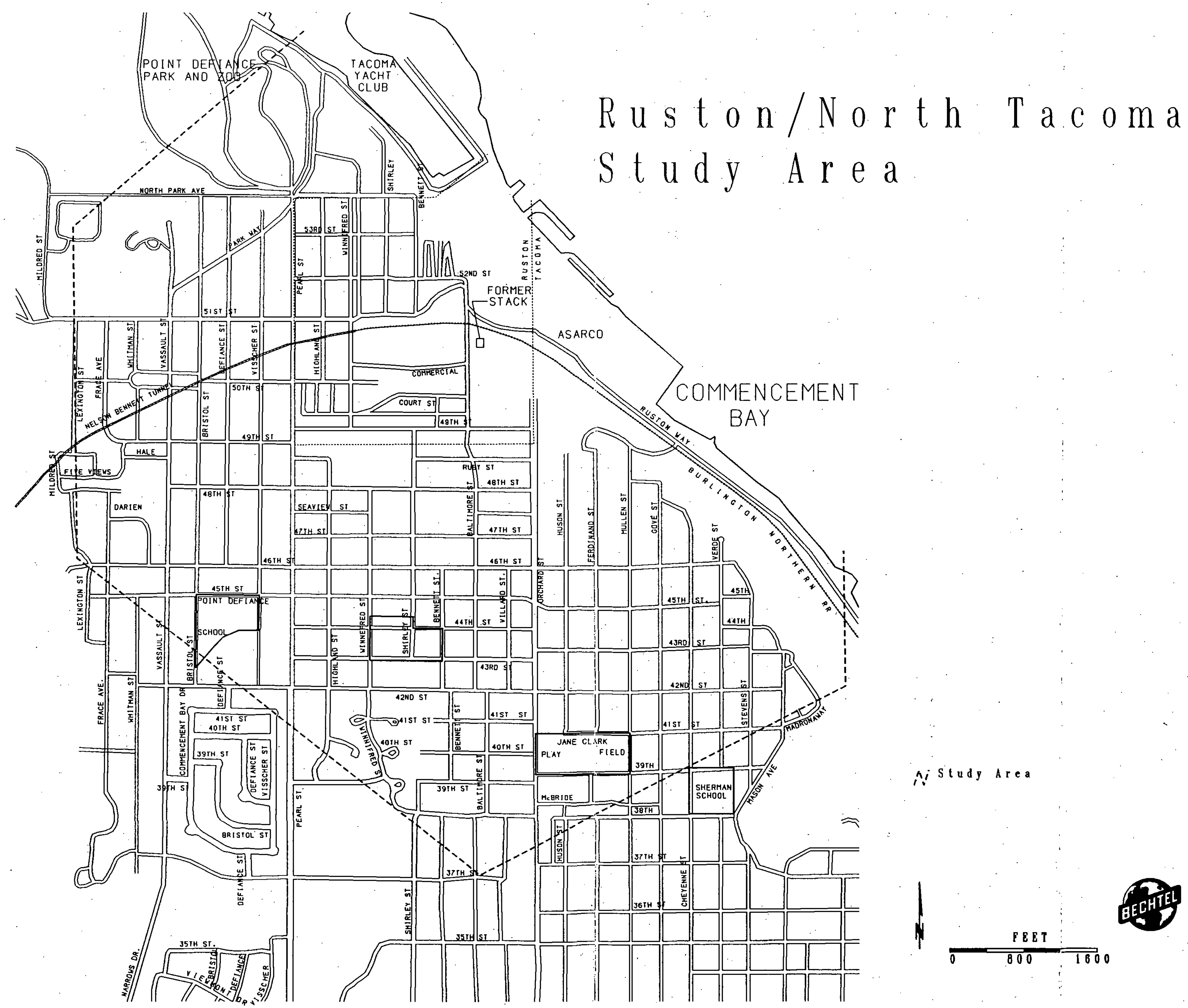
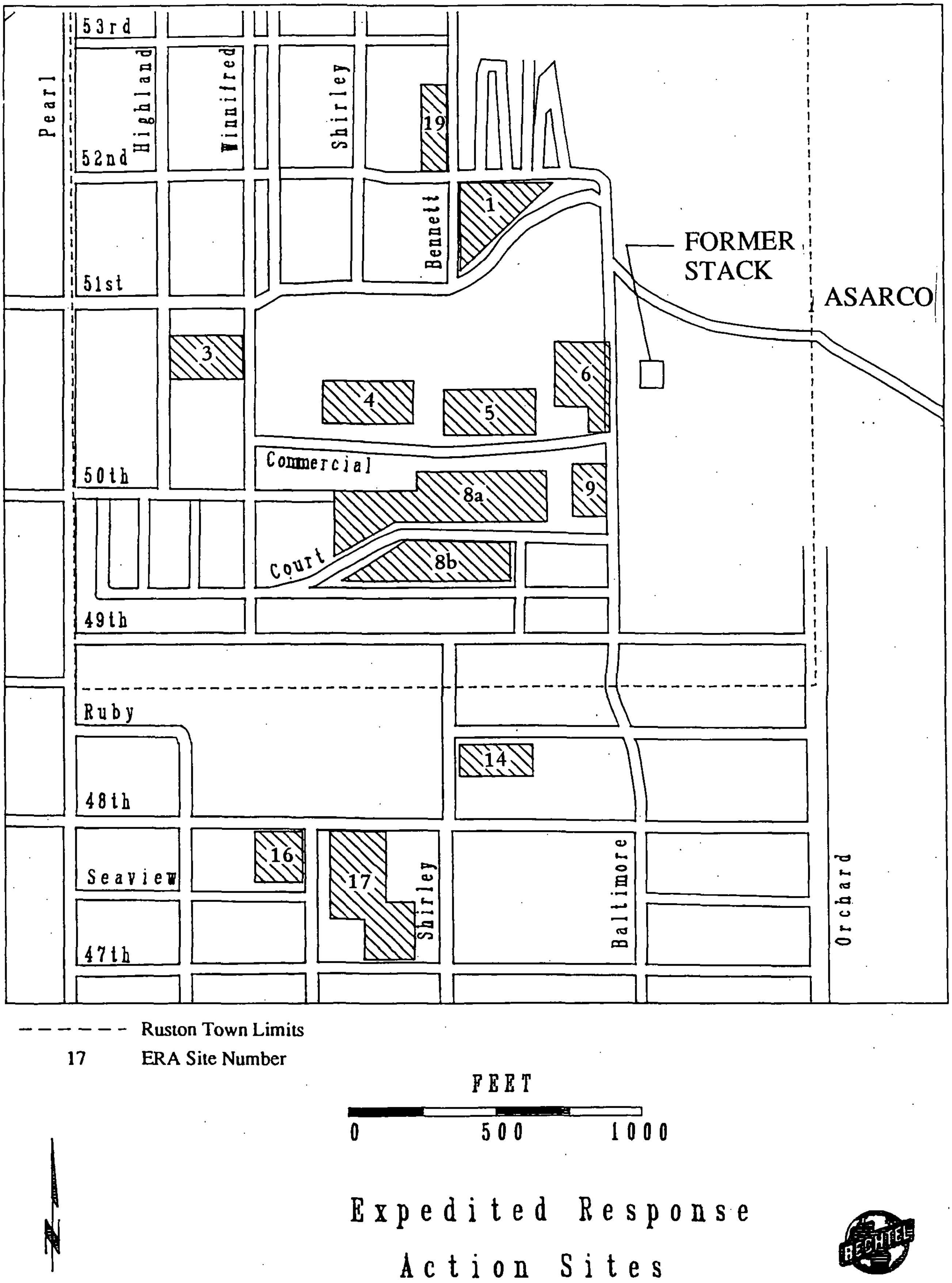
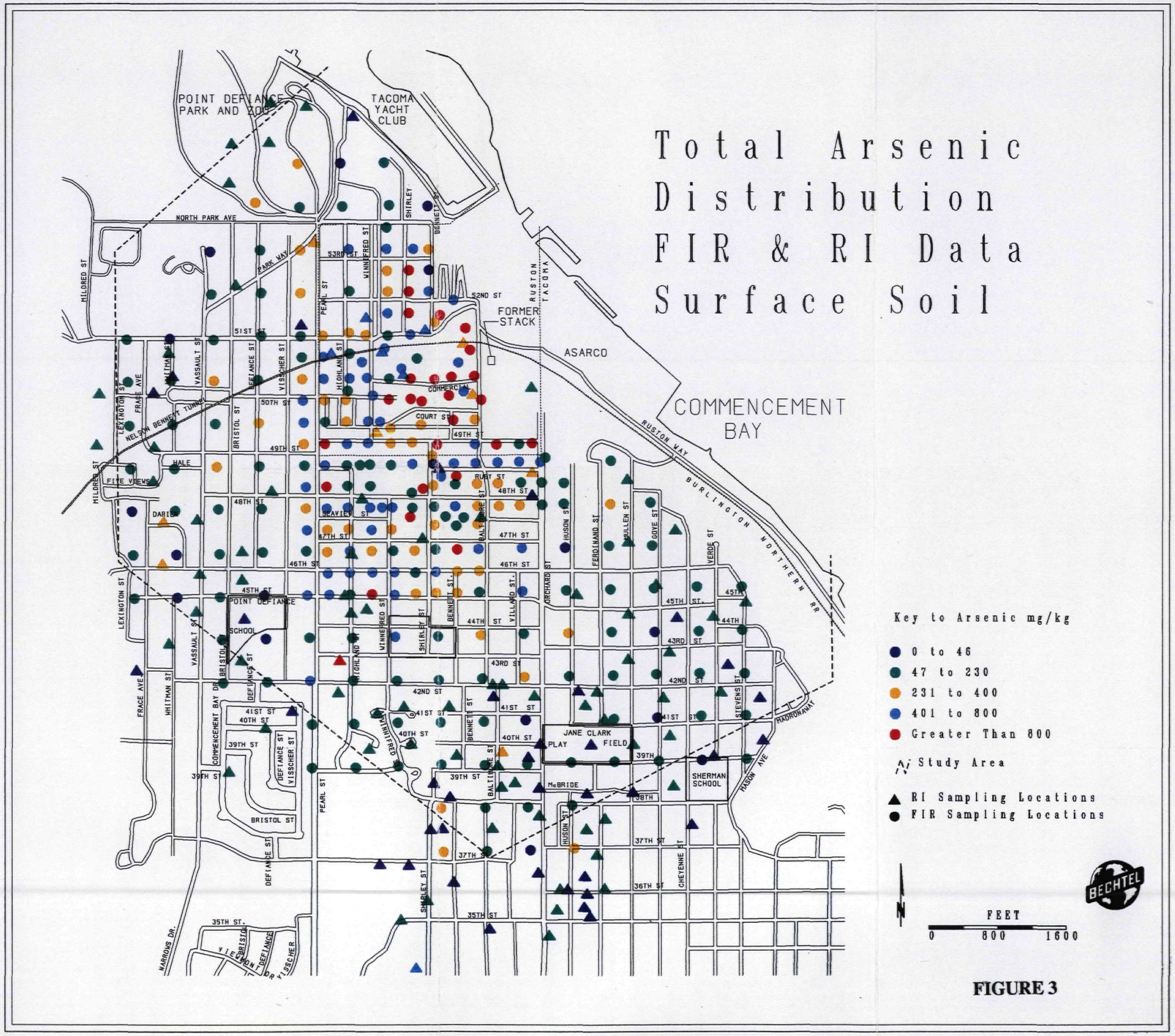


FIGURE 1



Expedited Response Action Sites

FIGURE 2



Total Arsenic Distribution
FIR & RI Data
Surface Soil
Key to Arsenic mg/kg
0 to 46
47 to 230
231 to 400
401 to 800
Greater Than 800
Study Area
RI Sampling Locations
FIR Sampling Locations
FEET
0
800
1600
BECHTEL
POINT DEFIANCE PARK AND ZOO
TACOMA YACHT CLUB
FORMER STACK
ASARCO
COMMENCEMENT BAY
RUSTON
TACOMA
RUSTON WAY
BURLINGTON NORTHERN RR
NORTH PARK AVE
POINT DEFIANCE SCHOOL
JANE CLARK PLAY FIELD
SHERMAN SCHOOL
NELSON BENNETT TUNNEL

FIGURE 3

Total Lead Concentration RI & FIR Data Surface Soil

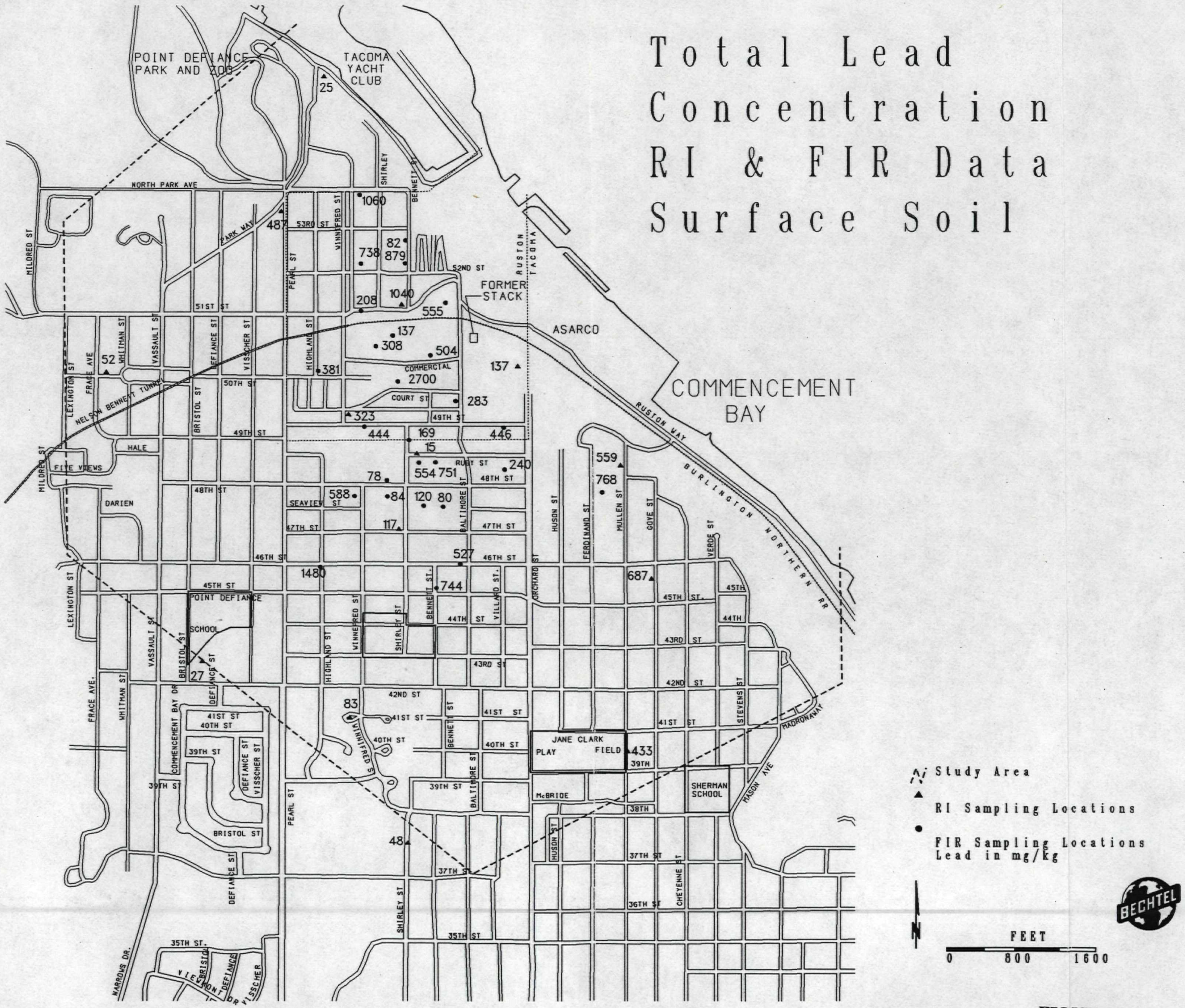
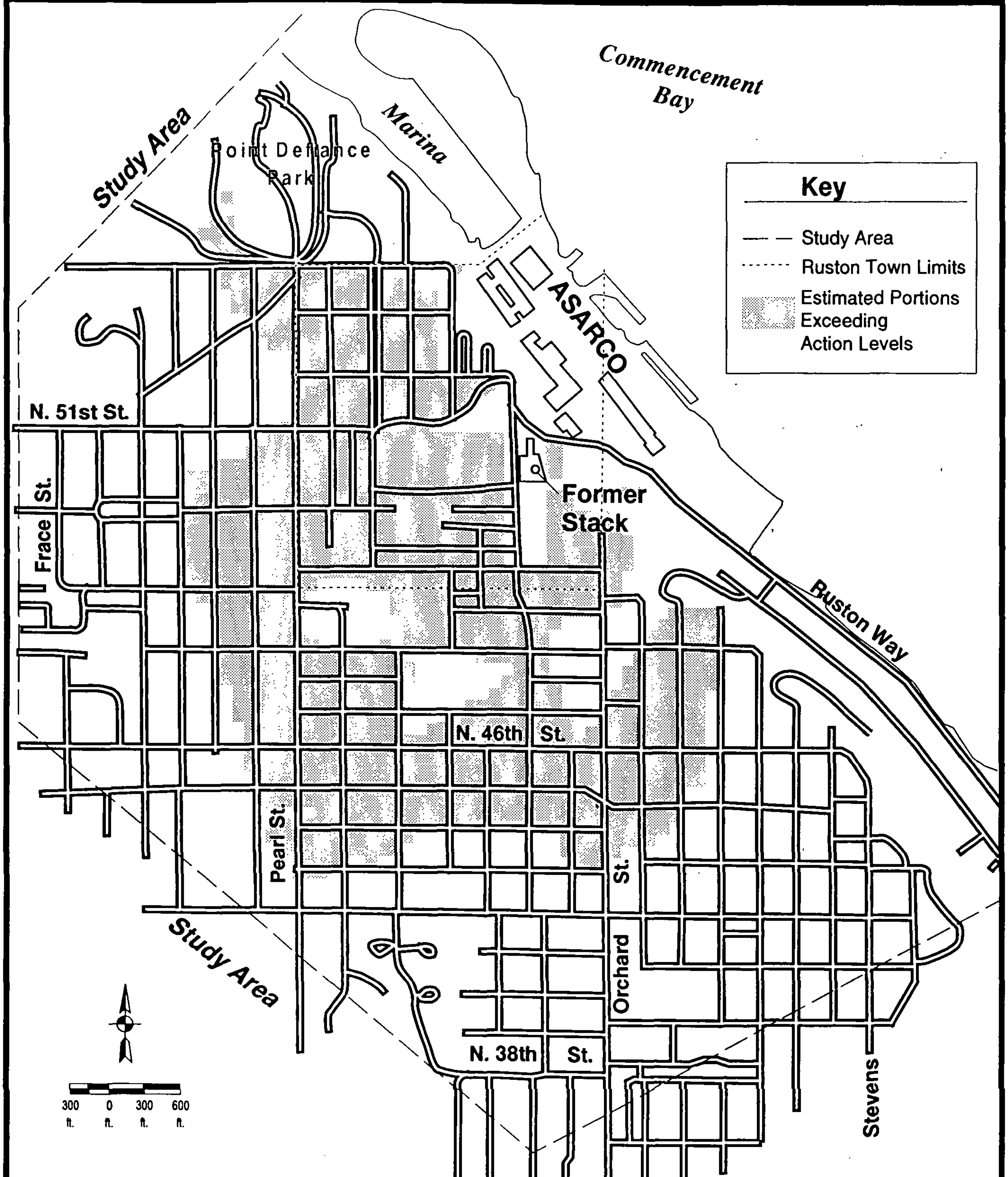
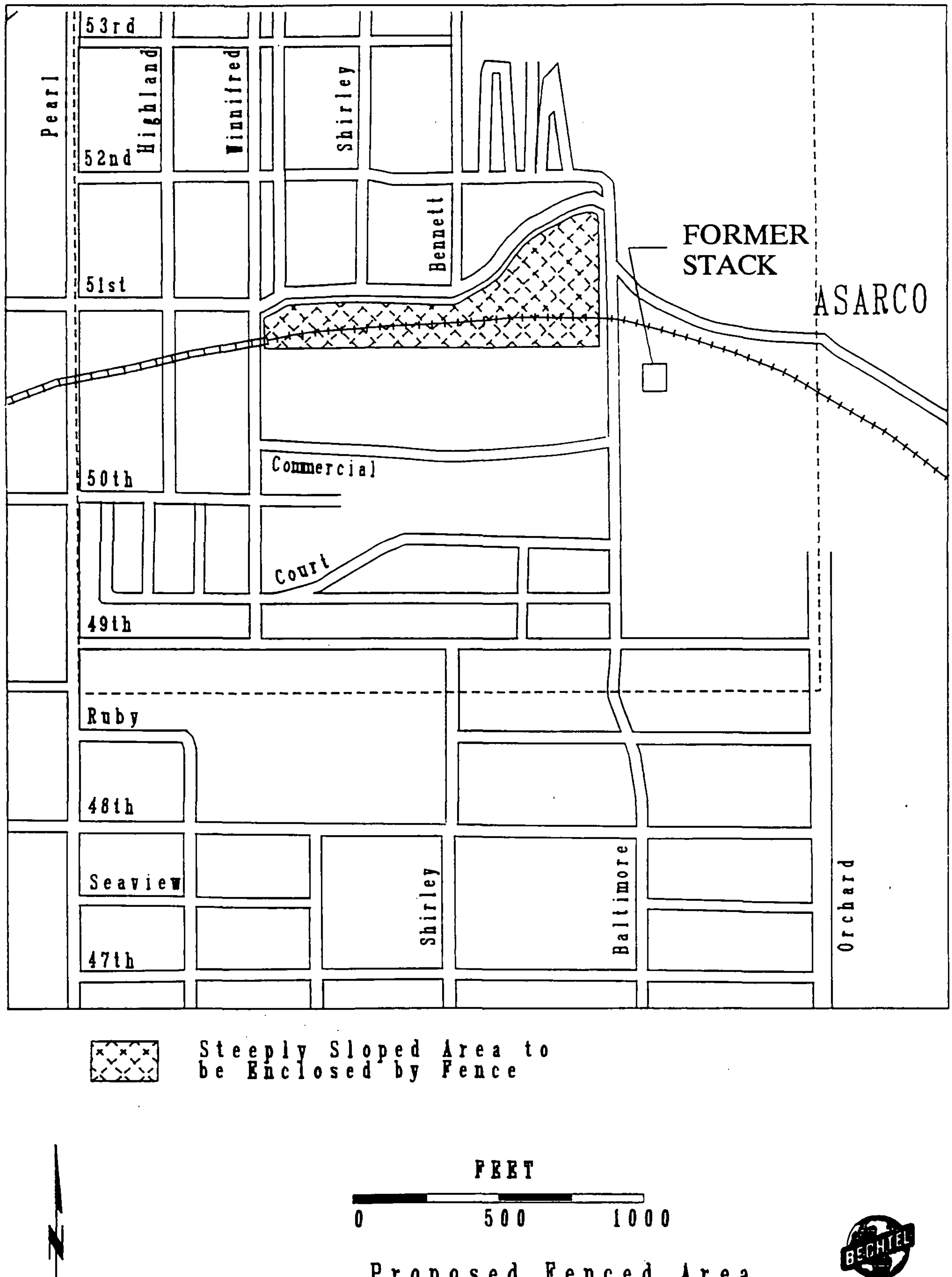


FIGURE 4

Figure 5:
Study Area and Estimated Portions Exceeding Action Levels



Based on the existing sampling results, EPA has estimated that the areas which are shaded on the map may require cleanup because they most likely exceed EPA's action levels. There could, however be properties within the shaded area that have soils with contamination below the action levels, and/or properties outside the estimated area that have contamination in excess of the action levels.



Proposed Fenced Area

FIGURE 6

TABLES

Table 1
RUSTON/NORTH TACOMA STUDY AREA
INFORMATION REPOSITORIES

Study Area	Address
In Tacoma:	McCormick Regional Branch Library 3722 North 26th (206) 591-5640 Tacoma Public Library, Main Branch * 1102 Tacoma Avenue, NW Room (206) 591-5622 City of Tacoma Environmental Commission 747 Market Street, Suite 900 (206) 591-5310 Tacoma Pierce County Health Dept. 3633 Pacific Avenue (206) 591-6553 Pacific Lutheran Library 121st & South Park Avenue (206) 535-7500 Citizens for a Healthy Bay 771 Broadway (206) 383-2429
In Ruston:	Ruston Town Hall 5117 North Winnifred (206) 759-3544
In Seattle:	U.S. Environmental Protection Agency * 1200 Sixth Avenue 7th Floor, Records Center (206) 553-4494
In Olympia:	Washington Department of Ecology 4415 Woodview Drive, S.E. (206) 438-3017

* The Administrative Record for the Ruston/North Tacoma Study Area is available at these two locations.

Table 2
LIST AND DESCRIPTION OF FACT SHEETS AND BROCHURES REGARDING THE RUSTON/NORTH TACOMA STUDY AREA

Date	Topic(s)
4/27/89	Described cleanup work underway at ERA sites and announced EPA's intent to conduct an overall investigation of the Study Area. The fact sheet also included information about the availability of a Technical Assistance Grant for local community groups.
7/14/89	Disclosed EPA's request that Asarco conduct an RI/FS, and invited the community to join a community workgroup.
9/89	Provided update of all Superfund projects in Tacoma.
11/1/89	Summarized the first community workgroup meeting, and provided opportunity for property owners to request soil sampling.
2/12/90	Introduced EPA's Community Liaison, and provided an update of site activities and progress of the Community Workgroup.
2/90	Provided update of all Superfund projects in Tacoma including a status report on Ruston/North Tacoma.
5/2/90	Announced the final RI workplan and EPA's plans to contact private property owners for access for sampling. Contained frequently asked questions and EPA's responses. Updated ERA activities and the Community Workgroup.
6/8/90	Announced the beginning of soil sampling and introduced EPA's new project manager.
8/90	Provided update of all Superfund projects in Tacoma including a status report on Ruston/North Tacoma.
11/5/90	Summarized soil sampling results, provided TPCHD recommendations for reducing exposure to soil contamination, and invited residents to a special Community Workgroup meeting to discuss the sample results.
2/13/91	Provided update of all Superfund projects in Tacoma, including the ERA sites, and the status of the Ruston/North Tacoma RI. Also included information on EPA's Community Workgroup and community interviews which were underway.
5/6/91	Provided update of all Asarco Superfund projects including community interviews and Community Workgroup for the Ruston/North Tacoma Study Area.
8/6/91	Provided update of all Superfund projects in Tacoma including the Ruston/North Tacoma RI, the Coordinating Forum, and Ecology's soil collection service for Study Area residents.
10/91	Distributed brochure describing all of the Superfund activities related to the Asarco smelter including the Ruston North Tacoma Study Area, the smelter site investigation and demolition, and marine sediments. This brochure continues to be available to members of the community upon request, and is provided as a handout at all of EPA's public forums.

Table 2
LIST AND DESCRIPTION OF FACT SHEETS AND BROCHURES REGARDING THE RUSTON/NORTH TACOMA STUDY AREA

Date	Topic(s)
2/10/92	Announced 60-day public comment period on EPA's RI/FS and Risk Assessment reports and two public workshops.
3/92	Under a cooperative agreement with EPA, TPCHD developed two brochures related to handling and disposal of contaminated soil in both residential and commercial settings. These brochures were developed by TPCHD with input from EPA, Department of Ecology and the members of the Coordinating Forum. TPCHD distributed the residential brochures via a bulk mailing to the Study Area. The commercial brochures were also mailed to a variety of interested groups and local government departments including: labor unions, schools, local parks, utilities and zoning departments, and business organizations. These brochures are also available at the permit counters in Tacoma and Ruston.
3/92	Provided update of all Superfund projects in Tacoma including the status of the first 60-day public comment period for Ruston/North Tacoma.
6/92	Distributed brochure for property owners, realtors, appraisers, and lending professionals to provide additional information on EPA's policies on liability for cleanup costs.
7/92	Summarized property transaction seminar held in June 1992.
7/14/92	Updated all Asarco Superfund projects including the Study Area. Also contained a summary of a property transactions seminar held by EPA.
8/14/92	Summarized EPA's Proposed Plan for cleanup. Provided information about the 60-day public comment period and two public meetings during that period.
11/92	Updated all Superfund projects in Tacoma including a status report on EPA's progress in responding to public comments and developing a Record of Decision. An update of ERA activities was also included.
1/11/93	Updated all Asarco Superfund projects including the Study Area.

Table 3
COMBINED REMEDIAL INVESTIGATION AND FIELD INVESTIGATION REPORT DATA FOR SURFACE AND SUBSURFACE SOIL SAMPLES FROM THE STUDY AREA

Range of metal concentrations in surface soils at 0 - 1" (in ppm):	
Arsenic:	7.0 to 3,000
Antimony:	0.0 to <4.3
Copper:	92.7 to 12,800
Mercury:	0.57 to 23.0
Cadmium:	<0.43 to 13.4
Lead:	24.7 to 2,700
Silver:	<0.84 to 30.6
Range of metal concentrations collected at 6 - 10" (in ppm):	
Arsenic:	2.1 to 2,900
Antimony:	<4.4 to 14.4
Copper:	79.7 to 1,080
Mercury:	0.0 to 0.36
Cadmium:	<0.48 to 15.2
Lead:	34.0 to 429
Silver:	<0.48 to 2.9
Range of metal concentrations collected at 12 - 16" (in ppm):	
Arsenic:	1.9 to 1,380
Antimony:	<4.7 to 13.7
Copper:	33.5 to 1,220
Mercury:	0.10 to 4.3
Cadmium:	<0.47 to 6.5
Lead:	6.5 to 660
Silver:	<0.47 to 3.8

Table 4
SUMMARY OF ARSENIC EXPOSURE FACTORS

Exposure Model		Age Group	Body Weight	Contact Rate	Frequency	Duration	Bioavailablity[a]	Arsenic Concentration
Ambient Air Inhalation		Adults	70 kg	$20 m^3$/day	350 day/yr	30 yrs	0.30	30 ng/m^3
Soil/Dust Ingestion		0-6 yrs 6-30 yrs	15 kg 70 kg	200 mg/day 100 mg/day	350 day/yr 350 day/yr	6 yrs 24 yrs	0.80 0.80	140 mg/kg 300 mg/kg 500 mg/kg 800 mg/kg (RME) 1600 mg/kg
Pica Soil/Dust Ingestion		0-6 yrs 6-30 yrs	15 kg 70 kg	500 mg/day 100 mg/day	350 day/yr 350 day/yr	6 yrs 24 yrs	0.80 0.80	140 mg/kg 300 mg/kg 500 mg/kg 800 mg/kg (RME) 1600 mg/kg
Slag/Dust Ingestion	slag dust	0-6 yrs 0-6 yrs	15 kg 15 kg	22.5 mg/day[b] 110 mg /day	350 day/yr 350 day/yr	6 yrs 6 yrs	0.40 0.40	10,000 mg/kg 100 mg/kg
	slag dust	6-30 yrs 6-30 yrs	70 kg 70 kg	11.25 mg/day[b] 55 mg/day	350 day/yr 350 day/yr	24 yrs 24 yrs	0.40 0.40	10,000 mg/kg 100 mg/kg
Dermal Contact		0-6 yrs 6-30 yrs 6-30 yrs	15 kg 70 kg 70 kg	3900 mg[c] 1900 mg[c] 5000 mg	350 day/yr 263 day/yr 87 day/yr	6 yrs 24 yrs 24 yrs	0.0015 0.0015 0.0015	140 mg/kg 300 mg/kg 500 mg/kg 800 mg/kg (RME) 1600 mg/kg

a Bioavailability factors are pathway specific according to the Baseline Risk Assessment.

b The slag/dust model incorporates a contact rate allocation factor that accounts for time and behavioral differences for indoor and outdoor exposures. The RME assumption is that 0.45 of the contact rate is associated with outdoor activities (i.e. slag and soil) and 0.55 is associated with indoor dust. The RME also assumes that 25% of the outdoor exposure is associated with slag at 10,000 mg/kg in the Baseline Risk Assessment.

c The dermal contact rate incorporates the area of skin exposed (cm^2) for winter and summer and a factor of 1.0 mg/cm^2 for adherence of soil particles to skin.

Definitions: kg = kilograms, m^3/day = cubic meter per day, ng/m^3 = nanograms per cubic meter, mg/day = milligrams per day, mg/kg = milligram per kilogram or parts per million (ppm), RME = reasonable maximum exposure.

Table 5
EXPOSURE FACTORS FOR THE GARDEN VEGETABLE EXPOSURE MODEL FOR ARSENIC

Vegetable Class	Age Group	Body Weight	Contact Rate[a]	Frequency[b]	Duration	Bioavailability	Plant Uptake Factor[c]	Soil Arsenic Concentration
Fruity	0-6 yrs 6-30 yrs	15 kg 70 kg	3.2 g/day 8.8 g/day	0.39 0.39	6 yrs 24 yrs	1.0 1.0	0.0014 0.0009 0.00066 0.0005 0.0003	140 mg/kg 300 mg/kg 500 mg/kg 800 mg/kg (RME) 1600 mg/kg
Leafy	0-6 yrs 6-30 yrs	15 kg 70 kg	0.3 g/day 1.4 g/day	0.11 0.11	6 yrs 24 yrs	1.0 1.0	0.02 0.02 0.02 0.02 0.02	140 mg/kg 300 mg/kg 500 mg/kg 800 mg/kg (RME) 1600 mg/kg
Root	0-6 yrs 6-30 yrs	15 kg 70 kg	1.5 g/day 2.5 g/day	0.19 0.19	6 yrs 24 yrs	1.0 1.0	0.0014 0.0009 0.00066 0.0005 0.0003	140 mg/kg 300 mg/kg 500 mg/kg 800 mg/kg (RME) 1600 mg/kg
Potatoes	0-6 yrs 6-30 yrs	15 kg 70 kg	8.7 g/day 23.5 g/day	0.11 0.11	6 yrs 24 yrs	1.0 1.0	0.0014 0.0009 0.00066 0.0005 0.0003	140 mg/kg 300 mg/kg 500 mg/kg 800 mg/kg (RME) 1600 mg/kg
Legumes	0-6 yrs 6-30 yrs	15 kg 70 kg	22.3 g/day 44.9 g/day	0.62 0.62	6 yrs 24 yrs	1.0 1.0	0.0014 0.0009 0.00066 0.0005 0.0003	140 mg/kg 300 mg/kg 500 mg/kg 800 mg/kg (RME) 1600 mg/kg

a Dry weight basis. Source: USEPA Methodology for Assessing Health Risks Associated with Indirect Exposure to Combustor Emissions, Interim Final, EPA/600/6-90/003, January 1990. See also Appendix G of the Baseline Risk Assessment.

b Diet fraction grown at home (see Appendix E of the Baseline Risk Assessment).

c Site specific factors (see Appendix E of the Baseline Risk Assessment).

Definitions: kg = kilograms, g/day = grams per day, mg/kg = milligram per kilogram or parts per million (ppm), RME = reasonable maximum exposure.

Table 6
SUMMARY OF AVERAGE DAILY DOSE
AT VARIOUS SOIL ARSENIC CONCENTRATIONS

Soil Arsenic Concentration	Averaging Time	Exposure Model				
		Pica (mg/kg/day)	Soil/Dust (mg/kg/day)	Vegetable (mg/kg/day)		Dermal (mg/kg/day)
				3 classes[a]	5 classes[b]	
20 mg/kg (urban background)	30 yrs 70 yrs	1.2×10^{-4} 5.1×10^{-6}	5.8×10^{-6} 2.5×10^{-6}	2.7×10^{-6} 1.2×10^{-6}	1.8×10^{-6} 7.7×10^{-6}	2.4×10^{-6} 1.0×10^{-6}
140 mg/kg (50th percentile)	30 yrs 70 yrs	8.4×10^{-4} 3.6×10^{-4}	4.1×10^{-4} 1.8×10^{-4}	1.9×10^{-5} 8.1×10^{-6}	1.3×10^{-4} 5.4×10^{-5}	1.7×10^{-5} 7.1×10^{-6}
300 mg/kg (75th percentile)	30 yrs 70 yrs	1.8×10^{-3} 7.7 x 10-^{4}	8.8×10^{-4} 3.8×10^{-4}	3.1×10^{-5} 1.3×10^{-5}	1.8×10^{-4} 7.6×10^{-5}	3.6×10^{-5} 1.5×10^{-5}
500 mg/kg (90th percentile)	30 yrs 70 yrs	3.0×10^{-3} 1.3×10^{-3}	1.5×10^{-3} 6.3×10^{-4}	4.3×10^{-5} 1.9×10^{-5}	2.2×10^{-4} 9.6×10^{-5}	5.9×10^{-5} 2.5×10^{-5}
800 mg/kg (RME)	30 yrs 70 yrs	4.8×10^{-3} 2.1×10^{-3}	2.3×10^{-3} 1.0×10^{-3}	6.1×10^{-5} 2.6×10^{-5}	2.8×10^{-4} 1.2×10^{-4}	9.5×10^{-5} 4.1×10^{-5}
1600 mg/kg (99th percentile)	30 yrs 70 yrs	9.6×10^{-3} 4.1×10^{-3}	4.7×10^{-3} 2.0×10^{-3}	1.0×10^{-4} 4.4×10^{-5}	3.8×10^{-4} 1.6×10^{-4}	1.9×10^{-4} 8.1×10^{-5}

a 3 Classes = fruity, leafy and root

b 5 Classes = fruity, leafy, root, potatoes and legumes

Definitions: mg/kg/day = milligram per killogram per day,
mg/kg = milligram per kilogram or parts per million (ppm),
RME = reasonable maximum exposure.

Table 7
AVERAGE DAILY DOSE FOR ARSENIC IN
THE SLAG/DUST AND AIR RME MODELS

Averaging Time	Exposure Model	
	Slag/Dust (mg/kg/day)	Air (mg/kg/day)
30 yrs	1.7×10^{-3}	2.5×10^{-6}
70 yrs	7.4×10^{-4}	1.1×10^{-6}

Definitions:
RME = reasonable maximum exposure,
mg/kg/day = milligram per killogram per day

Table 8
EXPOSURE PARAMETER AVERAGE VALUES FOR THE UBK MODEL
FOR 0 TO 6 YEAR OLD CHILDREN

Parameter	Value
Outdoor air lead ($\mu g/m^3$)	0.04*
Indoor air lead ($\mu g/m^3$)	0.032*
Time spent outdoors (hour/day)	3
Time weighted average ($\mu g/m^3$)	0.033
Breathing volume (m^3/day)	4.5
Lead intake from breathing air (μg/day)	0.14
Percent respiratory deposition/absorption	32
Lead uptake from air (μg/day)	0.045
Lead intake from diet (μg/day)	6.38
Percent gastrointestinal absorption	50
Lead uptake from diet (μg/day)	3.19
Outdoor soil lead (μg/g)	15 to 2700*
Indoor dust lead (μg/g)	15 to 2700*
Daily soil-dust ingestion rate (mg/day)	100
Weighing factors (soil/dust)	45/55
Lead intake from dust and soil (μg/day)	Variable
Percent gastrointestinal absorption	30
Lead uptake from dust and soil (μg/day)	Variable
Drinking water lead, U.S. average (μg/l)	4
Drinking water intake (l/day)	0.48
Lead intake from drinking water (μg/day)	1.92
Percent gastrointestinal absorption	50
Lead uptake from drinking water (μg/day)	0.96

* Site specific parameters. All others are EPA default values.

Source: adapted from USEPA Technical Support Document on Lead, ECAO-CIN-757, Jan. 1991, (Do Not Cite or Quote).

Definitions: UBK = Uptake Biokinetic Model, $\mu g/m^3$ = micrograms per cubic meter, m^3/day = cubic meter per day, μg/day = microgram per day, μg/g = microgram per gram or parts per million (ppm), mg/day = milligram per day, μg/l = microgram per liter, l/day = liter per day.

Table 9
ESTIMATED LEAD UPTAKE BY CHILDREN[a]
IN STUDY AREA

Soil Concentration (mg/kg)	Approximate Percentile[b]	Pathway Specific Intake[c]				Total Intake (µg/day)
		Air (µg/day)	Water (µg/day)	Diet (µg/day)	Soil/Dust (µg/day)	
20[d]	NA	0.045	0.96	3.19	0.6	4.8
250[e]	42	0.045	0.96	3.19	7.5	11.7
380	50	0.045	0.96	3.19	11.4	15.6
485	60	0.045	0.96	3.19	14.55	18.7
555	70	0.045	0.96	3.19	16.65	20.8
700	80	0.045	0.96	3.19	21.0	25.2
880	90	0.045	0.96	3.19	26.4	30.6
1060	95	0.045	0.96	3.19	31.8	36.0
1480	98	0.045	0.96	3.19	44.4	48.6
2700	100	0.045	0.96	3.19	81.0	85.2

a Zero to six year-old children

b Ranked for 41 data points (Remedial Investigation and Field Investigation Report)

c Based on UBK model output for specific soil concentrations

d Typical western U.S. soil background lead concentration

e Upper-percentile urban background lead concentration

NA = Not included as one of the 41 data points

Definitions: mg/kg = milligram per kilogram or parts per million (ppm),
µg/day = microgram per day

Table 10
ESTIMATED UPPER BOUND LIFETIME CANCER RISKS FROM EXPOSURE TO ARSENIC[a]

Exposure Pathway	Estimated Cancer Risk [b]
Air inhalation: (lung cancer)	5×10^{-5}
Air at 30 nanograms/cubic meter	
Ingestion by: (skin cancer:	
Soil/house dust at 800 ppm	2×10^{-3}
Garden vegetables at 800 ppm soil	5×10^{-5}
3 classes [c]	2×10^{-4}
5 classes [d]	1×10^{-3}
Slag/house dust	
Slag at 10,000 ppm	
House dust at 100 ppm	4×10^{-3}
Pica soil/house dust at 800 ppm	
Dermal absorption: (skin cancer)	7×10^{-5}
Soil at 800 ppm	

a Estimated cancer risks will vary depending on the soil arsenic concentration in individual yards. In this table, cancer risks at 800 ppm soil arsenic are used as an example to show the reasonable maximum exposure - the highest exposure reasonably expected to occur. Only five percent of the Study Area is expected to have soil arsenic concentrations exceeding 800 ppm. Risks will be less for those areas with lower soil arsenic concentrations.

b The cancer potency factor (slope factor) used for calculating risks for the ingestion and dermal absorption exposure pathways is 1.75 per mg/kg/day. The cancer potency factor (slope factor) used for calculating risks for the air inhalation exposure pathway is 50 per mg/kg/day. These factors were taken from the Integrated Risk Information System (IRIS).

c Fruity, leafy, and root.

d Fruity, leafy, root, potatoes, and legumes.

Table 11
ESTIMATED LIFETIME NONCANCER RISKS FROM EXPOSURE TO ARSENIC[a]

Exposure Pathway	Hazard Quotient[b]
Ingestion by:	
Soil/house dust at 800 ppm	2.9 to 7.8
Garden vegetables at 800 ppm soil	
3 classes[c]	0.1 to 0.2
5 classes[d]	0.3 to 0.9
Slag/house dust	2.2 to 5.8
Slag at 10,000 ppm	
House dust at 100 ppm	
Pica soil/house dust at 800 ppm	6.0 to 16.0
Dermal absorption:	
Soil at 800 ppm	0.1 to 0.3

a Estimated noncancer risks will vary depending on the soil arsenic concentration in individual yards. In this table, noncancer risks at 800 ppm soil arsenic are used as an example to show the reasonable maximum exposure - the highest exposure reasonably expected to occur. Only five percent of the Study Area is expected to have soil arsenic concentrations exceeding 800 ppm. Risks will be less for those areas with lower soil arsenic concentrations.

b As the Hazard Quotient rises above a value of "1", the potential for noncancer effects increases. A reference dose range of 0.3 ug/kg/day to 0.8 ug/kg/day was used in calculating these hazard quotients. This reference dose range was taken from the IRIS.

c Fruity, leafy, and root.

d Fruity, leafy, root, potatoes, and legumes.

TABLE 12

REMEDIAL ACTION OBJECTIVES AND REMEDIATION GOALS

REMEDIAL ACTION OBJECTIVES

Contaminant	Arsenic	Lead
Environmental Media	Soil	Soil
Exposure Pathway	Direct contact and incidental ingestion	Direct contact and incidental ingestion
Exposed Population	Current and future residents of north Tacoma and Ruston	Current and future residents of north Tacoma and Ruston
Remedial Action Objectives for Arsenic and Lead	Reduce potential exposure of current and future community residents to soil and dust so that these exposures will be within acceptable risk levels. Reduce the potential transport of soil contaminants inside homes or other buildings where exposures may occur.	

REMEDIATION GOALS

Contaminant	Arsenic	Lead
Goal	Reduce arsenic exposures to ensure that the upper-bound lifetime excess cancer risk to an individual is between 10^{-4} and 10^{-6}	Reduce exposures to lead to ensure that no individual has greater than a 5 percent chance of exceeding a blood lead level criterion of 10 µg of lead per deciliter of blood (10 µg/dL)
Contaminant Concentrations in Soil	230 ppm of arsenic	500 ppm of lead

TABLE 13
SUMMARY OF REMEDIAL ACTION ALTERNATIVES

Remedial Action Technologies/Options	Preferred Alternative	Feasibility Study Remedial Action Alternatives					
		1 No action	2 Limited Action	3 Sod and Asphalt Cap	4 One Foot Excavation and Onsite Storage	5 One Foot Excavation and Offsite Disposal	6 Excavation to Background Levels
No action		●					
Community protection measures	○		●	●	●	●	○
Sod/vegetation required	●			●	●	●	●
Underground utility construction implications	●				○	○	●
Temporary relocation	○						○
Soil cap	●				●	●	●
Asphalt cap (dirt alleys and parking areas)	●			●	●	●	●
Soil removal and backfill	●			●	●	●	●
Sampling to determine necessary depth of excavation	●						●
Off-site disposal	●			●	○	●	●
Environmental monitoring@	●			●	●	●	●
Fencing steeply sloped areas	●			●	●	●	●

Note:
● Indicates that technology is definitely applicable.
○ Indicates that technology may be applicable.
@ Environmental monitoring may be used to reassess the extent of contamination during the implementation of a remedy, to ensure the safety of cleanup personnel and residents during remedial action, to aid in the determination of the effectiveness of the remedial actions, or to create a baseline against which to measure exposure potential or reduction in lieu of remedial action.

TABLE 14

UNIT QUANTITY ESTIMATES FOR REMEDIAL ACTION LEVELS OF 230 ppm AND GREATER OF ARSENIC AND 500 ppm AND GREATER OF LEAD

Item	Preferred Alternative	Alternative 3, Asphalt Capping and Sodding	Alternatives 4 and 5, Excavation and Onsite Storage & Excavation and Offsite Disposal	Alternative 6, Excavation Until Background Concentrations of Arsenic and Lead are Achieved
Total number of acres as part of Alternative	273	273	273	273
Number of non-paved acres requiring remedial action+	109	109	109	109
Estimated number of residential lots included in action++	525	525	525	525
Soils removed/replaced at residential lots (cubic yards)+++	168,000	14,660	176,000	330,000
Sod required as cover (square yard)	528,000	528,000	528,000	528,000
Soils removed from alleys and unpaved parking lots (cubic yards)	11,000	11,000	11,000	11,000
Fencing required (linear feet)	3,500	3,500	3,500	3,500
Asphalt cap cover for alleys and parking lots (square yard)	66,000	66,000	66,000	66,000
Number of years to completion	7 years	1 year	7 years	12 years

Note: For Alternative 3 removal and replacement volumes are based upon placement of a 1 inch sod layer which is estimated to result in the removal of about two inches of soil over 50 percent of the area to be sodded.

For Alternatives 4 and 5 removal and replacement volumes are based upon a depth of excavation of 1 foot. The selection of 1 foot is based upon experience gained at similar sites, but the actual depth of excavation during remedial action may vary from this value.

\+ Value in table is approximately 40% of the total acreage. This fraction represents the portion of the total surface area not covered by homes, paved roads, and sidewalks. A complete description of the derivation of this percentage value is provided in the text, Section 2.4 of the feasibility study.

\+ + Number of homes within the designated total area. Estimate was made through inspection of aerial photographs of the site taken in 1988.

\+ + + Value represents volume of soil excavated and disposed. An equivalent volume of uncontaminated soil will be required as backfill.

Table 15	
EVALUATION CRITERIA	
EPA uses nine criteria to identify its preferred alternative for a given site or contaminant. With the exception of the no action alternative, all alternatives must meet the first two "threshold" criteria. EPA uses the next five criteria as "balancing" criteria for comparing alternatives and selecting a preferred alternative. After public comment, EPA may alter its preference on the basis of the last two "modifying" criteria.	
Threshold Criteria:	**1. Overall protection of human health and the environment** - How well does the alternative protect human health and the environment, both during and after construction? **2. Compliance with federal and state environmental standards** - Does the alternative meet all applicable or relevant and appropriate state and federal laws?
Balancing Criteria:	**3. Long-term effectiveness and permanence** - How well does the alternative protect human health and the environment after completion of cleanup? What, if any, risks will remain at the site? **4. Reduction of toxicity, mobility, or volume through treatment** - Does the alternative effectively treat the contamination to significantly reduce the toxicity, mobility, and volume of the hazardous substance? **5. Short-term effectiveness** - Are there potential adverse effects to either human health or the environment during construction or implementation of the alternative? How fast does the alternative reach the cleanup goals? **6. Implementability** - Is the alternative both technically and administratively feasible? Has the technology been used successfully on other similar sites? **7. Cost** - What are the estimated costs of the alternative?
Modifying Criteria:	**8. State acceptance** - What are the state's comments or concerns about the alternatives considered and about EPA's preferred alternative? Does the state support or oppose the preferred alternative? **9. Community acceptance** - What are the community's comments or concerns about the preferred alternative? Does the community generally support or oppose the preferred alternative?

Table 16
RUSTON/NORTH TACOMA -- SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

PART A: ALTERNATIVES AND CORRESPONDING ARARs

Description of FS Alternative	Applicable or relevant and appropriate requirements (ARARs) -- number corresponds to summary of statutory or regulatory requirements described below
Alternative 1 -- No action.	ARARs are not triggered for "no action" alternative.
Alternative 2 -- Limited action.	Under MTCA (see no. 2), limited action, or an action that relies primarily on inconstitutional controls or monitoring, is not acceptable where it is technically possible to implement a cleanup action alternative that utilizes a higher preference cleanup technology. If a component of a limited action remedy includes a soil collection service, see disposal requirements under no. 1.
Alternative 3 -- Containment of contaminated soil using asphalt capping and sodding.	See nos. 2, 5, 6, 7, 8, and 9. To the extent that excavation is conducted, see also 1, 3, and 4.
Alternative 4 -- Excavation of one foot of contaminated soil, backfilling with clean/uncontaminated soil, temporary storage of contaminated soil at Asarco smelter, and final disposal at a) Asarco smelter, or b) permitted land disposal facility.	See nos. 1 through 9.
Alternative 5 -- Excavation of one foot of contaminated soil, backfilling with clean/uncontaminated soil, disposal at permitted land disposal facility.	See nos. 1 through 9.
Alternative 6 -- Excavation of contaminated soil until background concentrations of arsenic and lead are achieved.	See nos. 1 through 9.
Preferred Alternative/Selected Remedy -- Excavation of contaminated soil to a maximum depth of 18 inches, backfilling with clean/uncontaminated soil, disposal or beneficial use on-site (if allowable under smelter cleanup) or disposal off-site in accordance with Ecology's final decision on petition for dangerous waste exemption.	See nos. 1 through 9.

Table 16
RUSTON/NORTH TACOMA -- SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

PART B: THE ARARs EXPLAINED

Statute or Regulation	Status	Requirement
(1) Dangerous Waste Regulations (WAC 173-303); Minimum Functional Standards for Solid Waste Handling (WAC 173-304).	Applicable to disposal of soil with concentrations of arsenic above 100 ppm **(WAC 173-303-103).** Relevant and appropriate to construction of storage or disposal areas on the smelter site (if allowable under smelter cleanup). State's area of contamination policy is a to-be-considered (TBC) rather than an ARAR.	WAC 173-303-141 requires that dangerous waste be taken to treatment, storage, or disposal (TSD) facility with RCRA permit or interim status authorization or facility that will legitimately treat or recycle waste. **[Note: Shaded language describes how the selected remedy will attain the requirements identified as applicable or relevant and appropriate.]** Ecology is evaluating Asarco's petition for exemption from the DW regulations. EPA expects that Ecology's decision on the exemption, when issued, will specify requirements for disposal of Ruston soil in an off-site facility. Ecology's dangerous waste requirements will be attained through compliance with Ecology's final decision. State's area of contamination policy states that dangerous waste may be consolidated, contained, or treated within the area of contamination without triggering the applicability of final disposal requirements, but such requirements may be relevant and appropriate.

Table 16
RUSTON/NORTH TACOMA -- SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

PART B: THE ARARs EXPLAINED (Continued)

Statute or Regulation	Status	Requirement
		WAC 173-303-660 specifies that "waste piles" (i.e., storage areas) shall be (1) covered to prevent wind dispersal and to prevent infiltration of rainfall, (2) include run-on and run-off control systems, and (3) include a drainage system to collect leachate within the pile. WAC 173-330-665 specifies requirements for landfills (i.e., disposal areas). Waste that is not a dangerous waste (e.g., contaminated vegetation) but is removed as a result of excavation should be disposed at a municipal landfill in compliance with minimum functional standards under WAC 173-304.
(2) Model Toxics Control Act (MTCA)(70.105D RCW; WAC 173-340).	Applicable to cleanup of contaminated soil.	Cleanup standards are described in WAC 173-340-700-707 and -740. Cleanup actions are described in WAC 173-340-360 (actions are ranked by preference -- treatment to disposal in landfill (on- or off-site) to containment to institutional controls). Institutional controls are described in WAC 173-340-440. For Ruston/North Tacoma site, EPA and Ecology have interpreted MTCA to require engineering methods (e.g., capping and/or soil removal) for properties above "action

Table 16
RUSTON/NORTH TACOMA -- SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

PART B: THE ARARs EXPLAINED (Continued)

Statute or Regulation	Status	Requirement
		levels" -- arsenic concentration above 230 ppm and lead concentration above 500 ppm. "Replacement" soil (i.e., soil that is used to replace contaminated soil that is removed) must be below concentrations commonly found in urban areas -- 20 ppm arsenic and 250 ppm lead. Requirements under MTCA will be attained by removing soil up to 18 inches in depth at properties that exceed action levels and replacing it with soil that does not exceed urban background levels. For Ruston/North Tacoma site, MTCA requires institutional controls for properties with soil with arsenic concentration between 20 and 230 ppm and properties where soil above 230 ppm arsenic remains below a cap of "clean" soil. This requirement will be attained through implementation of an education program, use of a database of sample results, and other community protection measures (see Section 9.10 of ROD).

Table 16
RUSTON/NORTH TACOMA -- SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

PART B: THE ARARs EXPLAINED (Continued)

Statute or Regulation	Status	Requirement
(3) Clean Air Act -- National Ambient Air Quality Standards (NAAQS)(40 C.F.R. Part 50). State Ambient Air Quality Standards (WAC 173-470). Cleanup Standards To Protect Air Quality (WAC 173-340-750).	Relevant and appropriate to activities that may result in emissions of contaminants.	Requires that ambient concentrations of lead not exceed 1.5 milligrams per cubic meter based on quarterly average, that particulates not exceed 50 micrograms per cubic meter annually and not exceed 150 micrograms per cubic meter for any 24-hour period. This requirement will be attained through dust control measures and monitoring during excavation activities.
(4) Puget Sound Air Pollution Control Agency (PSAPCA) Regulation 1.	Applicable to activities that may result in emissions of fugitive dust and hazardous contaminants, including arsenic.	Regulation 1 requires use of best available control technology to control emissions of fugitive dust. This requirement will be attained through dust control measures and monitoring during excavation activities.
(5) Surface water cleanup standards (WAC 173-340-730); State water quality standards for surface waters (WAC 173-203).	Applicable to activities that may result in discharges of contaminants into surface waters.	Requires treatment, removal, or containment measures to reduce discharges of hazardous substances into surface water (e.g., runoff from excavated areas), consistent with water quality standards for surface waters not to be exceeded. This requirement will be attained through drainage protection measures and periodic monitoring of surface water in order to ensure standards are not exceeded as a result of cleanup actions.

Table 16
RUSTON/NORTH TACOMA -- SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

PART B: THE ARARs EXPLAINED (Continued)		
Statute or Regulation	Status	Requirement
(6) Coastal Zone Management Act (16 U.S.C. § 1451) and Shoreline Management Act (90.58 RCW).	Applicable to development activities within 200 feet of shoreline.	Requires that development activities within 200 feet of shoreline be conducted in a manner consistent with approved state management programs. There are no surface water bodies on or in the immediate vicinity of the Study Area other than seasonal storm water drainage swells and gullies that flow into Commencement Bay.
(7) EPA Policy on Wetlands (40 C.F.R. Part 6, Appendix A). State designation of wetlands (WAC 173-22-040).	Considered for activities involving wetlands.	Requires determination of whether wetlands are present within site. If so, avoid adverse effects, minimize potential harm, and preserve and enhance wetlands to the extent possible. State-designated wetlands are regulated under the Shoreline Management Act (see no. 6 above). Whether wetlands are present will be determined during remedial design/ remedial action.
(8) Endangered Species Act (16 U.S.C. § 1651).	Applicable to endangered or threatened species or habitats.	Requires determination whether endangered or threatened species or habitats are present within the site. If so, procedures for conserving such species or habitats must be followed. Whether endangered or threatened species or habitats are present will be determined during remedial design/ remedial action.

Table 16
RUSTON/NORTH TACOMA -- SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

PART B: THE ARARs EXPLAINED (Continued)

Statute or Regulation	Status	Requirement
(9) National Historic Preservation Act (16 U.S.C. § 470). Archaeological Sites and Resources Act (27.53 RCW).	Applicable to properties included or eligible for listing on the National or State Register of Historic Places or properties .	Requires determination of whether listed or eligible properties are present within the site. If so, procedures for preserving properties or mitigating adverse effects must be followed. Whether eligible properties are present will be determined during remedial design/ remedial action.

Table 17
ESTIMATED COSTS OF REMEDIAL ACTION ALTERNATIVES (IN MILLIONS OF DOLLARS)

Alternative	Capital Cost	O & M	Total 1	Total 2
2	NA	$3	$3	$3
3	$20	$7	$27	$24
4a	$49	$7	$56	$43
4b	$80	$7	$87	$67
5	$75	$7	$82	$61
6	$117	$2	$119	$85
Preferred	$78	$2	$80	$59

Notes for Table 17

Alternative 4a Costs are for temporary storage and permanent disposal at the Asarco smelter facility.

Alternative 4b Costs are for temporary storage at the Asarco smelter facility followed by permanent disposal at an authorized off-site facility.

"Total 1" reflects estimated cost of disposal at a hazardous waste facility.

"Total 2" reflects estimated costs of disposal at a non-hazardous waste facility (i.e., capital costs are estimated to be less under "Total 2" than under "Total 1").

APPENDIX A

RUSTON/NORTH TACOMA RESIDENTIAL STUDY AREA RESPONSIVENESS SUMMARY

RUSTON/NORTH TACOMA
RESIDENTIAL STUDY AREA
RESPONSIVENESS SUMMARY

June 1993

EPA Region 10

TABLE OF CONTENTS

LIST OF ACRONYMS USED IN THIS DOCUMENT

ADEC	Alaska Department of Environmental Conservation
ASILs	Acceptable Source Impact Levels
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CPMs	Community Protection Measures
DOH	Department of Health
DOT	Department of Transportation
DW Regs	Washington State Dangerous Waste Regulations
Ecology	Washington State Department of Ecology
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ERA	Expedited Response Action
FHA	Federal Housing Authority
FIR	Field Investigation Report
FS	Feasibility Study
HUD	Housing and Urban Development
MTCA	Model Toxics Control Act
NCP	National Contingency Plan
ppb	Parts Per Billion
ppm	Parts Per Million
PRP	Potentially Responsible Party
QA/QC	Quality Assurance/Quality Control
RI	Remedial Investigation
ROD	Record of Decision
RME	Reasonable Maximum Exposure
TPCHD	Tacoma Pierce County Health Department
WEC	Washington Environmental Council

1. OVERVIEW

The U.S. Environmental Protection Agency (EPA) has compiled this Responsiveness Summary to respond to the comments received during two public comment periods, held in spring and fall 1992, regarding the Ruston/North Tacoma Residential Study Area. This document reflects all the comments that were either voiced at one of the four public meetings held during the comment periods, or submitted in writing during that time. Questions that were asked and answered at the public meetings are recorded in the meeting transcripts (which are available in the Administrative Record for the site - see Table 1), and are not included in this document.

Section 1 of this document provides an overview of the site and a summary of community concerns. Section 2 includes comments submitted by the public as well as EPA's responses. Comments submitted by Asarco and EPA's responses are included in Section 3.

a. Site Background

EPA and other federal, state, and local agencies are concerned about soil contamination in the residential area surrounding the Asarco Tacoma Smelter. Many studies have been conducted that conclude that operations at the smelter resulted in emissions of contaminants, primarily heavy metals including arsenic and lead, that have settled in the soil surrounding the smelter. Arsenic is of concern because it is known to cause cancer; lead is of concern because exposure to lead is associated with developmental problems in children. In addition, some residential areas contain slag (a black, rock-like material containing arsenic and other metals) that was a by-product of the smelting process at Asarco. Slag has been used in residential areas for driveways, in rockeries, and as garden ornaments; it remains in many locations within the Study Area.

In 1988, the Washington State Department of Ecology (Ecology) collected 288 soil samples from an area of approximately 950 acres surrounding the smelter. Because those samples showed high levels of arsenic, EPA and Ecology concluded that additional sampling should be conducted to further characterize the contamination, and that some steps should be taken immediately to reduce people's exposure to the arsenic. Of most concern were children who might be exposed. Asarco entered into an agreement with EPA to remove the arsenic-contaminated soil from 11 publicly accessible properties including playgrounds, fields, and vacant lots where children were likely to play. Clean soil was placed over the excavated areas in 1990, 1991 and 1992. This activity is commonly referred to as the "Expedited Response Action" or ERA.

In 1989, EPA began an investigation to collect additional information about the soil contamination in Ruston/North Tacoma. EPA focused its investigation on the area called the Study Area (see Figure 1). As part of this investigation, EPA developed a plan for the soil sampling, which was reviewed by the Ruston/North Tacoma Community Workgroup, a group convened in October 1989 that has met regularly since that time. The Remedial Investigation (RI) and Feasibility Study (FS) for Ruston/North Tacoma were completed in January 1992.

In the summer of 1990, EPA collected 222 soil samples to define more accurately the distribution of arsenic, lead and other metals in the Study Area. Although other metals were detected in soils, arsenic and lead present the greatest potential harm to human health at the concentrations found. The combined data from EPA and Ecology's sampling efforts show the highest concentration of arsenic detected locally to be 3,000 parts per million (ppm); typically, concentrations in urban areas do not exceed 20 ppm. The highest concentration of lead detected locally was 2,700 ppm; in most urban yard areas lead does not typically exceed 250 ppm.

EPA reached the following conclusions based on the sampling results:

(1) The highest concentrations of arsenic and lead are generally in the areas nearest to the smelter and generally decrease as one moves away from the smelter.

(2) Concentrations over short distances, even across a residential yard, are variable.
(3) In most cases, the amount of arsenic and lead decreases with depth.
(4) Arsenic and lead concentrations will not decrease significantly on their own over time.

EPA used these observations to assess potential risks to human health and to evaluate cleanup alternatives. The cleanup alternatives were put forth for public comment during the first public comment period from February 17 to April 17, 1992. The six cleanup alternatives were as follows:

- Alternative 1--no action (used for comparison);
- Alternative 2--limited action, relying on community protection measures (CPMs) (institutional controls);
- Alternative 3--sod and asphalt capping;
- Alternative 4--excavation of one foot of soil and disposal on Asarco property;
- Alternative 5--excavation of one foot of soil and disposal at permitted facility; and
- Alternative 6--excavation of all contaminated soil and disposal at a permitted facility.

EPA's Proposed Plan for Cleanup, released August 14, 1992, considered comments received on the six alternatives during the first public comment period, and combined aspects of several alternatives to best address the concerns.

b. Proposed Plan for Cleanup

In developing the Proposed Plan for Cleanup, EPA considered the following nine mandated Superfund cleanup evaluation criteria: (1) overall protection of human health and the environment, (2) compliance with federal and state environmental standards, (3) long-term effectiveness and permanence, (4) reduction of toxicity, mobility, or volume through treatment, (5) short-term effectiveness, (6) implementability, (7) cost, (8) state acceptance, and (9) community acceptance. EPA also developed five additional principles, based on public comments, that represent features that are important to the community if a significant cleanup action is to be implemented: (1) remove contaminated soil at properties exceeding action levels (contaminant concentrations above which soil would be removed) of 230 ppm arsenic and 500 ppm lead, (2) minimize the need for long-term legal or administrative measures on individual properties, (3) reduce uncertainties for homeowners by sampling individual properties and by planning for homeowner involvement in the cleanup process, (4) reduce the cleanup time as much as possible, and (5) minimize disruption to the community during cleanup. The Preferred Alternative outlined in the Proposed Plan for Cleanup, combining aspects of Alternatives 4, 5, and 6, called for removal of contaminated soil to a maximum depth of 18 inches, based on sampling results. EPA believes that the majority of properties would require excavation only within six inches of the surface.

The following are individual components of EPA's Preferred Alternative as outlined in the Proposed Plan. These components are further defined for the Selected Remedy in Section 9.0 of the Record of Decision (ROD).

(1) **Sampling.** Further sampling would be performed to determine which properties to cleanup.
(2) **Small Quantity Soil Disposal Program.** A soil collection program would be implemented before the cleanup for small amounts of soil that property owners have generated.
(3) **Excavation of Contaminated Soil, Sod, and Slag.** At properties exceeding action levels, contaminated soil, sod, and slag driveways would be excavated. Soil would be excavated to a maximum depth of 18 inches.
(4) **Properties Where Contamination Remains.** If contamination exists beyond 18 inches, the replacement soil would serve as a barrier to the contaminated soil.

(5) **Asphalt Capping.** Under the Preferred Alternative, dirt alleyways and dirt parking areas that exceed action levels would be paved. EPA further refined this component in the ROD to allow for soil removal and gravel replacement.

(6) **Fencing.** Areas too steep to remediate would be fenced and planted with shrubs.

(7) **Cleanup Schedule.** The cleanup would be divided into zones, and the cleanup would proceed one zone at a time. (The agency actively solicited comments on this topic during the second public comment period, following the release of the proposed plan.)

(8) **Information for Deed Notice.** If requested by an owner, EPA would provide a factual description of sampling results and/or the cleanup, for the purpose of a deed notice.

(9) **Safety Measures.** Safety measures and monitoring activities would be undertaken to control dust and minimize disruption.

(10) **Community Protection Measures.** The following Community Protection Measures (CPMs) would be implemented: maintenance and monitoring of soil, sod, and asphalt caps; establishment of safety procedures for construction and maintenance activities; establishment of a post-remediation soil collection and disposal program for any contaminated soil excavated after the cleanup; and the development of a data base to store the results for all of the properties that are sampled.

(11) **Educational Materials.** Public education materials would be developed and distributed to the community.

(12) **Trust Fund.** A trust fund or other funding mechanism would be established to provide resources for ongoing activities after soil removal.

(13) **Expedited Response Action Properties.** The ERA properties would be sampled at depth to determine if any underlying soil contamination exists, and to include them in the CPMs Program if contamination is found within a depth of 18 inches.

(14) **Disposal.** Current state regulations require disposal of soil with arsenic concentrations above 100 ppm at a hazardous waste facility, the nearest of which is in Arlington, Oregon. However, Asarco requested an exemption from Ecology. Ecology proposed to conditionally exempt soils between 100 and 230 ppm, and to provide alternative disposal options for soils above 230 ppm. A final decision is pending.

(15) **Cost of the Preferred Alternative.** The estimated cost would be in the range of $60 to $80 million, depending on whether the soil would be disposed at a non-hazardous disposal facility (low-end cost) or out of state at a hazardous waste facility (high-end cost).

(16) **Time to Complete.** Soil removal would take an estimated seven years to complete.

During the second public comment period, from August 17 to October 17, 1992, EPA received numerous comments and questions on the Proposed Plan for Cleanup. Based on the comments received, EPA has issued a final ROD regarding the proposed cleanup.

c. Summary of Community Involvement and Concerns

EPA has placed a high priority on community involvement in its activities because many Ruston and north Tacoma property owners and residents may be affected by EPA's Superfund actions. EPA has been meeting for about three years with representatives of the community who volunteer to serve on the Ruston/North Tacoma Community Workgroup to provide EPA with comments and suggestions on its activities. In addition to the two public comment periods in 1992, EPA has also worked to inform and involve the community through fact sheets, open houses, public meetings, individual community interviews, and other activities on a continuing basis.

A summary of the March 11, 1992 public meeting; transcripts of the March 31, September 2, and October 1, 1992 public meetings; and the public comment letters received by EPA are part of the Ruston/North Tacoma Administrative Record, which is available for viewing at EPA Region 10 and the Main Branch of the Tacoma Public Library (see Table 1). In general, commentors expressed concern about the soil contamination, its health effects, the effects on property values, and the issues surrounding soil removal, including cleanup plan design, CPMs, costs, action levels, sampling, and soil disposal.

Some commentors expressed concern about the potential health effects of contaminants on themselves and their children, but other commentors expressed disagreement with EPA's estimation that the contaminated soil posed a health risk above an acceptable level. Several commentors had questions or comments regarding the public health studies, particularly on the studies of urinary arsenic levels in children.

During the first public comment period, commentors expressed preferences regarding EPA's list of six alternatives proposed for cleanup of the contaminated soil. During the second public comment period, comments were voiced regarding the Proposed Cleanup Plan. Some commentors stated a preference that contaminated soil be removed, whereas other commentors stated that removal of soil was not necessary or was undesirable for other reasons, including health and safety issues involved in the cleanup itself. Some commentors called for homeowner choice as to whether or not soil is removed; several commentors raised concerns about contamination in dirt roads and alleys. Specific concerns were voiced about landscaping and the removal of vegetation.

Soil disposal was a topic of concern raised by several commentors, several of whom opposed soil storage or disposal on the smelter property, and others raised suggestions regarding possible treatment of soil. Some commentors called for guidance on the disposal of small amounts of soil from their own yards. Contaminant action levels (above which soil would be removed) constituted a topic of concern to some commentors, who remarked on the differences between EPA and Ecology action levels. Numerous comments and questions were raised regarding sampling and sample results; several commentors noted that two samples near their property suggested differing conclusions or cited other specific sampling concerns. Several commentors stated that the estimated time frame of 7 to 12 years was too long, and others urged EPA not to delay in implementing cleanup.

Many commentors inquired who would shoulder the cost of the cleanup, the taxpayers or Asarco. The Town of Ruston and the City of Tacoma inquired how CPMs would be funded and implemented. Several commentors questioned the efficacy of public education. Commentors almost universally opposed deed restrictions. This and other property concerns, regarding property values and marketability, and the ability of home buyers or owners to obtain financing for home purchasing or improvements, were raised repeatedly.

Some commentors expressed appreciation of EPA's and Asarco's past and current efforts, while others expressed criticisms of one or both organizations. Several commentors indicated disapproval of EPA or Asarco and what they viewed as action motivated only by organizational self-interest, which was seen as running counter to the public interest. One commentor suggested that EPA's actions are politically, not scientifically, determined. Some commentors expressed that Asarco had excessively endangered public health in its pursuit of profits; several commentors anticipated that Asarco would delay cleanup action. Asarco provided comments that are included in Section 3 of this Responsiveness Summary. The following section provides detailed responses to public comments.

2. PUBLIC COMMENTS AND EPA RESPONSES

Comments are grouped below in the following categories:

a. Cleanup Design
b. CPMs
c. Costs
d. Health Comments
e. Preferred Cleanup Plan
f. Preliminary Action Levels
g. Property Issues

h. Sampling and Sample Results
i. Soil Disposal
j. Miscellaneous

a. Cleanup Design

1. COMMENT: Several commentors expressed preferences on how EPA should prioritize the cleanup. Several options were suggested including: clean up the most contaminated areas first; give priority to daycares, schools, parks, playgrounds, and homes with children; cleanup yards on demand; cleanup yards at time of sale; and cleanup yards in groups, one area at a time, rather than by individual lots. The Town of Ruston expressed its preference that the areas with the highest concentrations of contaminants be cleaned up first. Several commentors suggested a combination of these approaches or an ordering of several priorities.

RESPONSE: In response to significant public comment on this issue, the cleanup of properties will generally proceed within an area (or identified zone) at a time, beginning with the most highly contaminated areas. EPA believes that this strategy will be the least disruptive to the community overall. Within the areas or zones, priority can be given to schools, parks, playgrounds, daycares, homes with children, or other areas where children tend to gather. EPA will continue to seek the community's input as zones are established and individual lots are scheduled for cleanup actions. (For additional information see Sections 9.7 and 9.16 of the ROD. Also see responses to comments 8 and 15 in Section 3a).

2. COMMENT: Several commentors including the Town of Ruston inquired about what would be done with plants, trees, flowers, and landscaping features during the proposed cleanup. The Town of Ruston expressed preference for leaving existing plantings if so desired by the homeowner, and suggested consulting landscaping experts. One commentor stated that EPA should be flexible on the issue of landscaping, but that the homeowner should pay for any improvements.

RESPONSE: In order to accomplish the selected remedy, i.e., dig up and replace yard soils, it will be necessary to remove certain vegetation (grass, plants, shrubs, small trees, etc.) from individual yards. The extent to which this is necessary will vary from one yard to another (e.g., large trees and shrubs will most likely be left in place). The lawn areas of remediated yards will be revegetated with sod and maintained to ensure that the grass cover becomes well established. Maintenance requirements are further discussed in Section 9.10(c) of the ROD. Sodding and the addition of any fertilizer will be performed by a landscape contractor using conventional construction equipment. Shrubs and other types of groundcover will be planted by hand.

The yard-specific vegetation removal and replacement plan will be developed on a property-by-property basis with the assistance of the homeowner. Reasonable attempts, which do not hinder the progress of the remediation and are not excessively costly, will be made to accommodate owners who wish to retain original landscaping.

3. COMMENT: One commentor asked if tree roots would break up the clean soil cap.

RESPONSE: EPA's selected remedy calls for soil replacement to a maximum depth of 18 inches. In those areas where a cap exists (i.e., contaminated soil remains below 18 inches), EPA believes that it is unlikely that tree roots will cause sufficient damage to inhibit the protectiveness of the soil cap.

4. COMMENT: The Town of Ruston suggested that the cleanup design should incorporate provisions to ensure adequate drainage.

RESPONSE: EPA agrees. Every attempt will be made to return properties to their original grade. Any drainage problems that occur as a result of implementing the remedy will be corrected. (For additional information see Section 9.17 of the ROD).

5. COMMENT: The Town of Ruston requested that an oversight committee of residents and local governments convene during the cleanup.

RESPONSE: EPA believes that local involvement in implementation is important and necessary for a successful cleanup. In addition to soil removal, EPA's cleanup plan calls for development of a CPMs Program. This aspect of the cleanup plan in particular will benefit from community involvement, specifically in developing public educational materials.

To ensure that the local community is involved in the cleanup, EPA's final cleanup plan includes hiring a coordinator for the CPMs Program through the Tacoma Pierce County Health Department (TPCHD). This coordinator will be responsible for the overall management of the CPMs Program and will be required to coordinate his or her efforts with the Town of Ruston, City of Tacoma, Ecology and EPA. (For additional information see Section 9.10 of the ROD). In addition to the more formal coordination, EPA will work individually with homeowners to ensure that cleanup activities are performed in a satisfactory manner (see Section 9.14 of the ROD).

6. COMMENT: One commentor asked if an environmental impact statement (EIS) had been performed for the proposed excavation plan.

RESPONSE: The Superfund law does not require separate development of an EIS at a Superfund site. EPA's RI and FS analyze the same issues generally considered under an EIS. In essence, the RI/FS is the functional equivalent of an EIS.

7. COMMENT: Several commentors expressed the general preference that in designing, planning, and implementing the cleanup, the agencies err on the side of safety and caution, rather than reducing costs.

RESPONSE: EPA agrees that the health and safety of community residents and workers is a very important aspect of the cleanup. The selected remedy calls for safety measures to be implemented during the cleanup that include air monitoring, dust suppression techniques, the establishment of truck routes, road maintenance and repair, and the use of any necessary personal protection gear by workers conducting the cleanup (see Section 9.9 of the ROD).

8. COMMENT: One commentor asked if EPA needed any volunteers to help in implementing the cleanup.

RESPONSE: EPA appreciates the willingness of this commentor to help in implementing the cleanup. EPA may be looking for volunteers to participate in a workgroup to help develop educational materials, which are part of the CPMs Program (see Section 9.10 of the ROD). For the soil removal and replacement work, EPA cannot simply enlist volunteers because there are federal requirements for training for workers who work with contaminated material. If EPA does the work itself, it will hire contractors who will in turn employ such trained workers. If Asarco agrees to conduct the cleanup, Asarco will be responsible for hiring a properly trained workforce.

b. Community Protection Measures

1. COMMENT: One commentor expressed the opinion that property notices should be required and information on cleanup and contamination levels should be available through the county clerk's office. Another commentor asked if properties would be deeded clean after the cleanup. One commentor expressed concern that notification of future homeowners would diminish property values and punish current homeowners unfairly.

RESPONSE: EPA realizes that any part of the cleanup action that may affect notices or property values is of significant concern to the residents within the Study Area. EPA has developed its cleanup strategy with this concern in mind.

EPA does not believe that it has the authority to unilaterally place restrictions or notices on homeowners' deeds. EPA is willing, however, to provide a factual description of sampling results or cleanup activities (e.g., stating that the property is below action levels or the soil removal has been completed) to homeowners for purpose of a deed notice that the homeowner could place themselves.

EPA will also establish a database with factual information on the status of cleanups in the Study Area. The database would be accessible to current residents (and tenants), prospective owners, and other interested persons (see Section 9.10 d of the ROD). EPA believes that this database can adequately provide the notice function described by the commentor without unduly or unfairly restricting individual property transactions.

2. COMMENT: One commentor suggested that CPMs include notification to any new tenants of any restrictions, requirements, and guidelines for soil disturbance.

RESPONSE: EPA and Ecology intend that the educational component of the CPMs Program will be comprehensive and that information on how to reduce or prevent contact with remaining contaminated soils will be widely distributed to all residents within the Study Area, both owners and tenants, on an ongoing basis. In addition to property owners and tenants, real estate professionals and others involved in property transactions will be provided with educational information.

3. COMMENT: One commentor wondered if the proposed trust fund for ongoing activities would cover the costs of CPMs, or if the Town of Ruston would have to absorb the cost. Tacoma mayor Karen Vialle stated that the City of Tacoma did not endorse any CPMs but noted that the financial burden to the Town and the City should be addressed.

RESPONSE: The CPMs and education programs would be funded either by EPA or Asarco. EPA believes that the CPMs and education programs can most effectively be implemented if EPA, Ecology, Ruston, Tacoma, and the TPCHD share leadership and responsibility for these programs. EPA will work with the appropriate state or local agencies or municipalities to ensure a reasonable interaction between CPMs activities and government activities, such as issuing building permits that are routinely implemented and funded by state and local agencies or municipalities. The intent of the CPMs Program is to provide for the continued effectiveness of the selected remedy over the long term, but not to take over or significantly add to routine government activities.

4. COMMENT: One commentor suggested that public education, conducted with the help of volunteer residents, is needed in order to show residents how they may stop track-in of soil and dust and how they may clean effectively.

RESPONSE: EPA's CPMs Program and Community Relations Program (included in the selected remedy and discussed in Sections 9.10 and 9.16 of the ROD) require educational measures on a variety of issues including how to control soil disturbances, and how to minimize the potential for exposure to contaminated soil. In the past, the TPCHD has suggested frequent house dusting and wet mopping as measures to minimize the tracking of dust and dirt inside homes. It is expected that these measures will continue to be valid both during and after the residential cleanup, and included in any educational aspects.

5. COMMENT: The Town of Ruston requested that it be allowed to review all educational material before distribution to the community. The Town also asked who would implement the CPMs on properties owned by the local governments. It called for staffing and funding for implementation of any CPMs.

RESPONSE: Both EPA and Ecology consider the Town of Ruston, the City of Tacoma, and the TPCHD to be partners in developing an educational program that meets the needs of the affected community. The ROD calls for a full-time TPCHD staff person to coordinate the CPMs Program (including the educational components), as well as coordination of the overall Program with the above listed entities. Because the CPMs Program is part of the Selected Remedy in the ROD, funding would be provided to local governments, as necessary, to implement any required measures. EPA anticipates that the local governments will be responsible for routine maintenance and monitoring of caps on any properties owned by the local governments (i.e., general maintenance and repair activities, not those related to failure of the remedy).

6. COMMENT: Several commentors doubted that public education via printed materials would be an effective means of controlling exposure and criticized this measure as inadequate.

RESPONSE: EPA would like to clarify that one primary purpose of educational materials is to address soils below EPA's action levels. Although the risks posed by such soils are minimal, EPA believes that residents should have information about how they can voluntarily prevent or reduce their exposure to such soils and any remaining residual risk. The effectiveness of the materials will depend largely on the interest of the residents in implementing the recommendations contained in the materials.

7. COMMENT: One commentor suggested that families need to be aware that they should restrict children's access to high-dust (and therefore high-contaminant) areas such as attics and crawlspaces until they can be cleaned.

RESPONSE: EPA is not proposing to clean the inside of homes as part of the remedy. Historically (during the period of smelter operations and emissions) housedust samples showed elevated arsenic levels. Since shut-down of the smelter, and the corresponding reduction in airborne arsenic levels, EPA believes that the primary mechanism for contamination inside the home is through the tracking-in of dust and dirt from the outdoors. The cleanup of residential soils will reduce the potential transport of soil contaminants inside homes or other buildings where exposures may occur. EPA notes, but does not draw any site-specific conclusions from, that a recent journal article ("Behavior of Urban Dust Contaminated by Chernobyl Fallout: Environmental Half-Lives and Transfer Coefficients", R.W. Allott et al. 1992, Environmental Science & Technology 26, 2142-2147) evaluated the behavior and residence time of dusts inside homes, using the radioactive cesium released from the Chernobyl accident as a tracer substance. The results of that study suggest that dust contamination levels will decrease exponentially over time after elimination of the source of contamination, with an average time to reduce levels by one-half of less than one year. The authors also note that their study provides support for the importance of the mechanical transport pathway (tracking of soil particles) in contributing to indoor dust contaminant levels.

It is possible, however, that areas such as attics, inside walls, and crawlspaces (generally undisturbed areas) may contain elevated arsenic dust concentrations. Unless disturbed, dust in walls and attics does not pose an exposure hazard. EPA agrees with the commentor that children should be restricted from these high dust areas. If access to such areas is necessary, precautions regarding contact should be taken. Also see response to comment 2 in Section 2d below.

8. COMMENT: One commentor asked what measures are planned for monitoring the remedy over the long term. One commentor asked specifically what is planned for asphalt cap maintenance.

RESPONSE: EPA's CPMs Program includes provisions for maintaining the integrity of the caps, and for evaluating the effectiveness of the remedy and the overall CPMs Program. Guidelines for conducting development projects in capped areas will be prepared, including provisions for soil testing, transportation and disposal services. EPA anticipates that property owners will be responsible for general maintenance of soil caps on their properties, and the City of Tacoma and Town of Ruston will be responsible for maintaining caps on public access areas and roadways (i.e., general maintenance activities, not those which may be related to the failure of the remedy). In addition, visual inspections will be conducted to monitor the effectiveness of soil and asphalt caps.

9. COMMENT: The Town of Ruston expressed objection to fences, as they reinforce the perceptions of a contaminated community and limit property owners' use of their property.

RESPONSE: As part of the selected remedy, steeply sloped areas that cannot be capped with asphalt or sodded will be fenced and planted with low-lying shrubs (see Section 9.6 of the ROD). The fence will serve as a physical barrier, and the propagation of natural vegetation will serve to reduce erosion. The only steeply sloped area identified during the FS in this category is very limited in size; the land on either side of the railroad tracks in the Town of Ruston (see Figure 6 in the ROD). The need for any remediation activities in this area will be determined based on further sampling. EPA does not propose to fence any properties in the residential areas of the site.

c. Costs

1. COMMENT: Some commentors wanted to know who would pay for the cleanup, Asarco or the taxpayers.

RESPONSE: Under the Superfund law, (1) EPA can perform the cleanup work using money from the Superfund and seek reimbursement from Asarco, (2) Asarco can agree to perform the work, or (3) EPA can compel Asarco to perform the work. EPA has not yet determined whether EPA or Asarco will perform the cleanup in the Study Area.

The Superfund is funded through taxes on petrochemical companies, costs recovered by EPA from companies responsible for releases of hazardous substances, and general tax revenues. General tax revenues constitute 12 percent of the fund.

2. COMMENT: One commentor asked who is paying the salary of the EPA project manager.

RESPONSE: Salaries of EPA employees are paid by EPA. EPA can, however, seek reimbursement from companies responsible for releases of hazardous substances for its payroll costs of EPA employees who work on Superfund sites.

3. COMMENT: The Town of Ruston inquired how it will be decided who is responsible for the costs of cleanup, if, on individual properties, lead is deemed to be the only contaminant of concern.

RESPONSE: EPA or Asarco will cleanup properties that exceed the action level for lead when it appears that the lead contaminants are the result of emissions from the smelter, and not other possible sources. EPA has limited authority under the Superfund law to cleanup lead in soil from other sources, (e.g., lead-based paint). Also see responses to comments 11 and 27 in Section 3d.

4. COMMENT: One commentor wondered whether EPA had considered the purchasing or buyout of homes, because, the commentor noted, the cost of cleanup may be more than the value of the property.

RESPONSE: EPA has not considered the buyout of homes in the Ruston/North Tacoma Study Area as a remedial alternative. EPA estimates that as many as 525 residential lots will require cleanup. These properties would still require cleanup, based on existing arsenic and lead levels, even if a buyout were to occur. In addition, based on extensive community relations activities in the Study Area, EPA believes that many residents have strong ties to the community and would object to such an action. The intent of the cleanup is to remove contamination to the extent possible in order to minimize the need for long term legal or administrative measures on individual properties.

5. COMMENT: Several commentors identified cost as a low priority in evaluating cleanup alternatives. One commentor stated that an inadequate cleanup that leaves either risk or perceived risk will cost more in property values than any additional cost in the cleanup.

RESPONSE: EPA is required under the Superfund law to select cleanup actions that are cost-effective. Cost effectiveness takes into account the cost of the remedy and its effectiveness over the long-term. EPA believes that the selected remedy is cost-effective because it requires as much removal of contaminated soil from the community as is feasible (see Section 10.3 of the ROD). EPA believes that removal of the contaminated soil is likely to have a beneficial impact on property values.

6. COMMENT: One commentor stated that somebody bears a grudge against Asarco and is attempting to hurt them financially.

RESPONSE: EPA contends that it is implementing the requirements of the Superfund law in a fair and impartial manner. EPA is using the same investigation and decision-making process at this site as is used in connection with hundreds of other sites across the country involving thousands of companies.

7. COMMENT: One commentor suggested that EPA's use of large amounts of taxpayers' money constitutes fraud or deliberate misuse.

RESPONSE: EPA believes that this cleanup is necessary to protect human health and that the action selected is cost-effective and fully consistent with requirements under the Superfund law. Also see response to comment 1 in this section above.

8. COMMENT: One commentor intending to build homes on a piece of property wanted to know if a trust fund or other source could be used to help defray the extra cost incurred by disturbing the cap when building new homes with basements.

RESPONSE: The selected remedy includes provisions for development on properties that would involve disturbing a soil cap. In the event of such an activity, soil testing, transportation and disposal services would be made available at no cost to the property owner (see Section 9.10 b of the ROD). The property owner will be responsible for notification and coordination of such activities with the people providing such services.

9. COMMENT: Several commentors stated that the cost imposed on Asarco for the proposed cleanup would be a payment of a hidden cost of conducting business over the years.

RESPONSE: Comment noted.

d. Health Comments

1. COMMENT: Several commentors expressed concern and asked questions regarding the possible health risks associated with soil contaminated with arsenic and lead, and the long-term effects, particularly to children playing in dirt and dust. Several other commentors expressed concern that health risks have been overstated. One commentor stated that how a person takes care of his or her own health is more important in determining overall health than exposures to copper, lead, and other metals.

RESPONSE: Many studies of people have shown that exposure to arsenic and lead can adversely affect health. For arsenic, the primary effect of concern is cancer. Arsenic has been shown to cause lung cancer when inhaled and to cause skin cancer and cancers in organs such as the liver, lung, bladder and kidney when ingested. The risk of getting cancer from arsenic is thought to increase as a person's exposure increases. Low levels of lead exposure in young children can adversely affect learning and behavior. At higher exposures to lead, many other parts of the body (e.g., the blood-forming and reproductive systems) can be impacted.

Exposure of children to soils contaminated with arsenic and lead is of special concern. Children are more likely than adults to be exposed to the contaminants in soil and dust because of their behavior (e.g., children often put items that may be covered with soil and dust into their mouths, such as their hands, toys, and food from the ground). In addition, children are more sensitive than adults to lower exposures of lead, probably because children absorb more lead from their stomachs than adults and because their nervous systems are still developing.

In its Risk Assessment, EPA used the best method available to estimate the health risks for people exposed to contaminated soil and dust in the Study Area. This method was developed to estimate risk for those people in the Study Area having "reasonable maximum exposures" or RME (i.e., those people thought to have some of the highest exposures, but not necessarily the maximum exposures). This ensures that the risks predicted and the remedies selected will protect most of the people living in the Study Area. Because there are many uncertainties in the risk assessment method used and because EPA errs on the side of safety in dealing with these uncertainties, the actual site risks are unlikely to be higher than those estimated by EPA and could be lower.

EPA agrees that how a person takes care of his or her own health is a major factor in preventing sickness and increasing lifespan. EPA also agrees that this factor may, in some cases be a more important health determinant than reducing exposures to contaminants in the Study Area. It is important, however, to keep in mind that although people can make choices about their lifestyles in relation to health, exposure to environmental pollution is often involuntary and does not offer any economic or other benefit to those who are exposed. Risks from such exposures are clearly unacceptable to many people even though they may be lower in magnitude than those related to lifestyle. The environmental laws written by Congress with which EPA must comply, and EPA's national Superfund regulations, reflect the fact that risks from exposure to environmental contaminants are of concern to people in the U.S. and should be reduced to the extent needed to protect health.

2. COMMENT: Several commentors expressed concern specifically over the dust from alleys. Others noted that dust collecting in houses and attics may pose a risk, and should be sampled. One commentor stated that air and dust in schools should be tested.

RESPONSE: The soil and dust in unpaved alleys will be sampled and, if the concentrations of arsenic and lead exceed EPA's action levels, these alleys will be paved with asphalt to provide an impermeable barrier to contaminants, or contaminated soil will be removed and replaced with gravel.

Because the Asarco smelter is no longer operating, the primary manner in which housedust can become contaminated is through tracking indoors of contaminants from soils and slag. The removal of slag and of soils with contaminants exceeding EPA's action levels, and replacement with clean soils, will significantly reduce contamination of housedust. In areas of a house that are cleaned frequently, the levels of arsenic and lead in housedust will decrease over time. (See the discussion of the Allott et al. 1992 journal article, on changes in indoor dust concentrations over time, under the response to comment 7 in section 2b above). For areas such as attics where cleaning is infrequent, contaminant levels in dust may decrease more slowly than in the rest of the house. EPA expects, however, that exposures to contaminants in dust in these infrequently cleaned areas will be minimal because residents do not spend as much time in these areas as in the rest of the house. When working in such areas of the house, precautions for handling contaminated soils or dust should be followed; i.e., wearing protective clothing, refraining from eating, drinking or smoking, and washing hands and face when finished. Also see response to comment 7 in Section 2b above.

There are three schools that are within the Study Area or near the perimeter of the Study Area: Bates Vocational Tech, Point Defiance School and Sherman School. Contaminated soil at Bates Vocational Tech has already been excavated as a part of an ERA. Soil samples taken at Point Defiance and

Sherman Schools showed arsenic levels well below EPA's action level of 230 ppm. Further soil sampling will be conducted at these schools as part of the remedy (see Section 9.1(a) of the ROD). Based on the existing soil sample results, however, EPA does not believe that the dust or air at these schools need to be tested or remediated.

3. COMMENT: Several commentors stated that Asarco should be held accountable for risking the health of residents. One commentor suggested that Asarco endangered the health of residents in its pursuit of profit.

RESPONSE: EPA believes that Asarco is responsible for remediation to address increased health risks that may result from exposure to smelter contaminants in the Study Area. Now that the cleanup alternative has been chosen, Asarco will be given the opportunity to pay for and conduct the cleanup. If EPA is unable to reach agreement with Asarco, EPA may direct Asarco to do the cleanup under an enforcement order, or EPA will carry out the cleanup and recover the costs from Asarco. Also see response to comment 1 in Section 2c above.

4. COMMENT: One commentor expressed health concerns regarding the soil that will be used to replace the soil that will be removed.

RESPONSE: As discussed in EPA's Proposed Plan and Section 9.3 d of the ROD, excavated soil and sod will be replaced with clean soil and sod. Clean soil will be required to have arsenic and lead levels at or below those commonly found in urban areas, namely, 20 ppm for arsenic and 250 ppm for lead. EPA believes that even lower levels for the replacement soils, especially lead, are achievable, e.g., lead less than 100 ppm.

5. COMMENT: One commentor asked about the health effects of slag.

RESPONSE: In the Risk Assessment prepared by EPA for the Study Area, the health risks from exposure to arsenic in slag and housedust contaminated by slag were estimated. As with soil, the major concern for slag exposure is the potential for swallowing slag as a result of hand-to-mouth activity. Children are of greatest concern because they tend to mouth items (food, toys, and hands) that may be contaminated with slag particles. The Risk Assessment concluded that exposure to the elevated arsenic levels in slag, like soil, may present an additional risk of cancer when the slag is in small particles, such as in driveways. Large pieces of slag used as ornamental rock are not expected to result in much exposure. Because EPA believes that slag exposure may pose unacceptable risks, driveways and other areas containing small particles of slag will be excavated. Also see the responses to comments 12 and 25 in Section 3d below.

6. COMMENT: The Town of Ruston stated that there are impacts on the health and the quality of life of residents due to stresses associated with living in the Study Area. The Town states that these stresses, including difficulties in obtaining home financing for purchasing or improving homes, should be considered significant. The Town suggested that EPA has generated hysteria and that EPA should admit its mistake in order to remove the stigma that it has created.

RESPONSE: EPA did not deposit the contaminants on the community, Asarco did. Accordingly, any stresses that are a result of the cleanup made necessary by Asarco should be laid clearly at the foot of the polluter. EPA believes that the current conditions in the Study Area pose unacceptable risks over the long-term to residents as a result of arsenic and lead contamination in the soil. As a result, EPA has determined that physical removal of soil, sod, and slag are necessary at those residences where levels exceed EPA's action levels. It may be true that there are, as the commentor suggested, additional impacts on the health and the quality of the life of the residents because of issues other than exposure to contaminants. However, all of these impacts, whether health related or not, will be reduced or eliminated once the site cleanup is implemented. Therefore, EPA will proceed as quickly as possible to implement the cleanup actions that have been chosen and work with the community residents to reduce such stresses during the cleanup itself.

7. COMMENT: The Town of Ruston noted that the removal of a large amount of soil itself poses risks of injury or death.

RESPONSE: EPA believes that the risks from removal of large amounts of soil from the Study Area will be minimal. This conclusion is based upon experience at other hazardous waste sites where soil removal in residential areas was conducted as part of the cleanup. The experience at these sites (e.g., the Bunker Hill Superfund Site in Idaho), has shown that when appropriate management practices are implemented as part of the excavation, risk is significantly reduced or minimized. These practices will include but not be limited to dust control and safety measures such as: wetting soil before excavation, lining and covering truck beds when transporting contaminated material, cleaning truck wheels before they leave the excavation area, and selecting truck routes that will minimize disruption to the community. Air monitoring will also be required during soil removal and replacement actions to provide information on the effectiveness of control measures and to correct any problems that may occur. Also see the responses to comments 5 and 13 in Section 3d below regarding transportation risks.

8. COMMENT: One commentor stated that her bladder cancer may be attributable to arsenic.

RESPONSE: Although there is a possibility that the commentor's exposure to arsenic may have contributed to her bladder cancer, there are many other factors that may contribute to the development of bladder cancer, such as exposures to certain dyes and infections with parasites. The results of studies of people in Taiwan who drank arsenic-contaminated well water show that they have an increased risk for developing skin cancer as well as cancers of the bladder, kidney, lung, liver, and colon. Several reviews of the bladder cancer data from the Taiwanese study, as well as from other studies of arsenic-exposed populations, are available (see "Arsenic Ingestion and Internal Cancers: A Review", M.N. Bates et al., 1992, American Journal of Epidemiology 135, 462-476; "Cancer Risks from Arsenic in Drinking Water", A.H. Smith et al., 1992, Environmental Health Perspectives 97, 259-267).

9. COMMENT: Several commentors suggested that assumptions used in the health risk assessment were unsubstantiated. The Town of Ruston suggested that 30 years as an assumption used for home ownership by EPA in its health risk assessment may be high considering that many people do not live there that long. However, another commentor viewed this estimate as an underestimate, given the fact that some people live there longer than 30 years.

RESPONSE: Most of the exposure assumptions used in EPA's Risk Assessment were based upon guidance developed by EPA's national Superfund program and are the same assumptions used in developing risk assessments for Superfund sites throughout the country. Some of these exposure assumptions are well documented while others have less data to support them (see EPA's Risk Assessment for a more detailed discussion of these). When data were limited for a particular exposure assumption, such as soil ingestion or length of residence, EPA developed conservative values to ensure that risks would not be underestimated at Superfund sites.

The value of 30 years for the length of time a person would live in the same residence was derived from national studies. These studies show that about 10 percent of the U.S. population lives in the same home for 30 years or more. Information collected by the Washington State Department of Health (DOH) as a part of one of the epidemiological studies done in Ruston showed that the average (median) number of years of residence for the individuals in this study, all of whom were women and who lived within several miles of the smelter, was greater than 30 (i.e., one half or more of the women lived in the area for 30 years or more). Although these data are for past years of residence, they tend to support the use of a 30-year exposure duration for the Risk Assessment done by EPA.

10. COMMENT: Several commentors called for further public health studies before concluding that the contaminated soil was not safe, stating that existing health data was inconclusive or that it proved that no health effects occur. One commentor stated that people new to the area should not be included in public health studies.

RESPONSE: The "public health" studies done in the Study Area which might relate to exposures from the Asarco smelter were evaluated in EPA's Risk Assessment and compared to the results of the Risk Assessment. These public health studies include those done to determine if lung cancer deaths or adverse effects on the fetus were at higher than normal levels in the vicinity of the smelter. The results of these health studies have not shown statistically significant increase in adverse health effects. However, these results are not inconsistent with EPA's Risk Assessment. This is because the risk levels of concern to EPA's Superfund program are generally at levels that are difficult to detect in public health studies. In addition, it is very important to point out that none of these studies looked for increased rates of skin cancer, which was the type of cancer for which EPA estimated the risk in its Risk Assessment.

Given the inability of public health studies to detect the relatively low risk levels of concern in EPA's Superfund program, EPA does not feel that further studies are needed to conclude that contaminated soil in the Study Area should be removed. Also see the response to comment 10 in Section 3d below.

In addition, urinary arsenic sampling (not a "health" study but a study of exposure) has been performed several times since the early 1970s to determine if individuals, especially children, living in the vicinity of the smelter have elevated levels of arsenic in their urine. The 1988 urinary arsenic study that was conducted by the TPCHD showed that some children still had elevated levels of arsenic in their urine. In EPA's Risk Assessment, those data were assessed to determine if it supported lower exposures than those estimated in the Risk Assessment and, therefore, lower cancer risks. That analysis did not provide a reason to reduce the exposures and risks calculated in the Risk Assessment for those people in the Study Area thought to be more highly exposed; nor did it provide a reason to change EPA's conclusion that some soil removal is needed. (As discussed in more detail in the response to comment 12 below, it is not possible to use the more recent urinary arsenic data that was collected by the TPCHD over the past year to further this analysis because only a very small number of young children living near the smelter were tested.) Also see the responses to comments 29 and 30 in Section 3d below.

11. COMMENT: Several commentors suggested that EPA should test adults, particularly long-term residents of the area, in addition to children, for urinary arsenic levels.

RESPONSE: Under the terms of the 1989 Consent Order between EPA and Asarco for cleanup of the ERA sites, EPA required that Asarco give $60,000 to the TPCHD to provide sampling and analysis of urine for individuals in the Study Area upon request. This testing is available for both adults and children. Please contact Norm Payton of the TPCHD at (206)591-6532 for more information. EPA and the Tacoma-Pierce County Health Department have in the past focused on monitoring urinary arsenic levels in young children because they have generally higher potential exposures (e.g., higher soil/dust ingestion rates) and have been shown to reflect higher urinary arsenic levels than adults.

12. COMMENT: The Town of Ruston stated that current urinary tests of children do not reveal even trace amounts of arsenic.

RESPONSE: During 1992 and continuing through 1993, the TPCHD has been testing samples of urine from those people in the Study Area that request it. This program is funded by Asarco as part of a Consent Decree between EPA and Asarco (see comment 11 directly above). The results of this recent sampling effort are useful in providing information to individuals about the levels of arsenic in their urine and, therefore, about potential recent exposures to arsenic. However, as discussed further below, they cannot be used to make general statements about the levels of arsenic in the urine of children living near the smelter nor to make comparisons to urinary arsenic levels found in previous studies by the TPCHD or the University of Washington (Pathways Study).

In the Pathways Study done in 1986, the most highly elevated levels of arsenic were found in children under the age of 6 years living within 0.5 miles of the smelter (21 children). As a result, the 1988 TPCHD study, which was done after the smelter ceased operations, was limited to sampling arsenic in urine in children under 8 years of age within 0.5 miles of the smelter (88 children). The results of the TPCHD study showed that more than 27 percent of the children sampled had at least one urinary arsenic value above 25 parts per billion (ppb) and more than 18 percent had average urinary arsenic levels over time exceeding 25 ppb, the high end of the "normal background" 95th percentile level for urinary arsenic in the general population.

In the 1992 urinary arsenic data collected by the TPCHD, urine from 44 children and adults was analyzed. Of these 44, only 5 were children under the age of 8 living within about 0.5 miles of the smelter (another 2 children attended daycare within 0.5 miles of the smelter). It is inappropriate to make any conclusions about current exposures for young children living close to the smelter (within 0.5 miles) given that only 5 children have been sampled and only a single sample was taken from each. It is also inappropriate to compare these 5 samples to the previous TPCHD study from 1987 and conclude that arsenic levels in urine have been dropping. Also see the responses to comments 8 and 21 in Section 3d below.

13. COMMENT: One commentor suggested that EPA was afraid to discover that the health hazards were not as great as "EPA wanted."

RESPONSE: EPA has no preferential interest in identifying elevated health risks in the Ruston/North Tacoma community. EPA's conclusion that the current conditions in the Study Area pose unacceptable risks to residents is based on the use of standard EPA risk assessment methods that are used at all Superfund sites in the country (see responses to comment 1 in this section, and comments 7 and 15 in Section 3d below.). EPA evaluated health risks in the Baseline Risk Assessment, and has selected appropriate cleanup actions in accordance with agency guidance and the National Contingency Plan (NCP) - the document that guides EPA's Superfund program. EPA also evaluated the public health studies and exposure studies conducted in the Study Area to ensure that they were consistent with the conclusions drawn from the use of these standard risk assessment methods.

14. COMMENT: One commentor stated that what today seems like a conservative estimate of health risk may change based on new information.

RESPONSE: EPA's estimation of the risk in the Study Area is based on the use of the best methods and information available when the Risk Assessment was done. However, as pointed out in this comment, the estimates of the health risks in the Study Area could change if new widely accepted scientific information becomes available. This new information could lead EPA to conclude that it had overestimated or underestimated the risks. If such new widely accepted scientific information does become available, EPA will evaluate it and determine its impact on health risks estimated for the Study Area.

e. Preferred Cleanup Plan

1. COMMENT: Several commentors believed that the homeowners should decide what to do with their property and whether or not they want their soil removed. One commentor expressed preference for removal of soil first from those properties whose owners request it, and subsequently for others as their need arises, such as for selling property. Several commentors wanted to know if EPA will force property owners to have their property cleaned up even if they do not want it.

RESPONSE: EPA intends to make every effort to work with residents in a cooperative manner (e.g., EPA will work with property owners to arrange for access to properties to sample and conduct any necessary cleanup activities, and to define the details of any necessary landscaping). EPA does have the option to take enforcement actions to implement or complete the selected remedy if necessary. These actions are not taken lightly, however, and EPA would first consider several factors, including the level of contamination, public accessibility to the property in question, and any adverse impacts from not implementing the remedy.

2. COMMENT: Several commentors including the Town of Ruston expressed preference that all contaminated soil be removed, even if contamination exists deeper than 18 inches. Several commentors additionally indicated that owners of ERA sites should have the option of having all the contamination removed.

RESPONSE: The removal of contaminated soil above EPA's action levels to a "maximum" depth of 18 inches was selected as a best balance between cleanup Alternatives 4 and 5 (excavation to one foot) and Alternative 6 (removal of all contaminated soil above background concentrations regardless of depth). In all but one of the 23 soil depth profile samples collected during the RI, soil arsenic concentrations were less than the 230 ppm arsenic action level at 12 inches deep. EPA believes, based on this existing soil depth profile data, that the majority of properties will not require excavation beyond 6 inches to achieve the arsenic action level. The overall need for long term CPMs on individual properties after the cleanup will thereby be reduced.

As part of the cleanup, EPA intends to sample the ERA sites to a depth of 18 inches below the existing soil caps. If contaminated soil is found above EPA's action levels, the ERA property would be included in the CPMs Program. EPA does not believe, however, that additional soil excavation at ERA sites is necessary. See section 9.12 of the ROD.

3. COMMENT: Several commentors expressed preference that EPA pave all the dirt roads because they are a major source of dust and may recontaminate yards.

RESPONSE: As part of EPA's selected remedy, dirt alleys and parking areas with contaminants that exceed the action levels will be paved with asphalt to provide an impermeable barrier to the contaminants, or the contaminated soil would be removed and replaced with gravel. See Section 9.5 of the ROD for further information.

4. COMMENT: One commentor expressed preference that the removed soil be treated rather than simply disposed, and that piping or other materials removed with the soil be salvaged. Another commentor asked if it is possible to dilute the soil, rather than remove it.

RESPONSE: As part of the identification and screening of technologies conducted in the FS, EPA evaluated both soil treatment and dilution (tilling). In addition, a soil washing treatability study was conducted using soils collected from the Ruston/North Tacoma site. The results of the screening process and the treatability study indicated that treatment was neither practical nor effective in reducing contamination levels. Treatment alternatives, therefore, were dropped from further consideration.

Soil dilution (or the tilling of soil), has been considered at several other Superfund sites. A review of pilot studies conducted at these sites indicated that although surface soil concentrations were generally decreased, an increase in soil metal concentrations at depth was observed. A review of RODs for other Superfund sites did not identify any sites where this technology was selected for the purpose of reducing inorganic contamination of soil. In addition, under the Washington State Model Toxics Control Act (MTCA) (173-340-360(5)(e)(iii)), the cleanup action shall not rely primarily on dilution and dispersion of the hazardous substances if active remedial measures are technically possible.

Although all possible precautions will be taken, it is possible that the excavation of soil from properties may result in the excavation of and damage to some underground utilities, sprinkler systems, fences, foundations, yard lighting, etc. EPA will try to anticipate these problems by working with homeowners, municipalities, and utilities to prepare sketches of each property that identify all known underground items. Any items damaged during excavation will be repaired or replaced if possible.

5. COMMENT: Several commentors stated that EPA should clean up the portions of Point Defiance Park, including the Camp Six logging exhibit, that are outside the Study Area, because the park is often visited by children. One commentor suggested that EPA coordinate with the Metropolitan Park District in this effort.

RESPONSE: EPA is currently limiting its cleanup activities to areas within the Study Area, with the exception of three properties immediately south of the Study Area where concentrations significantly above the action levels were detected. EPA will evaluate the need for further sampling and appropriate cleanup activities outside of the Study Area separately from this ROD. Arsenic soil samples taken from within the Point Defiance Park area do not indicate significant exceedances of the arsenic action level, e.g., 238 ppm and 240 ppm arsenic.

6. COMMENT: Several commentors had questions or comments about "self-service" cleanup: whether they could implement cleanup of their own yard, where to take soil, and whether they could be provided with appropriate safety equipment and/or guidance.

RESPONSE: EPA cannot offer financial or contractor support for yard cleanups conducted by an individual homeowner. EPA understands, however, that individuals have been conducting and will continue to conduct yard maintenance and landscaping activities to improve the environment around their homes. For these and other types of soil disturbing activities, EPA suggests that you follow the guidelines outlined in the brochure "Contaminated Soil - Handling and Disposal in Residential Environments" in order to reduce or limit exposure to contaminated soils. The brochure was developed by the TPCHD and is available by contacting Norm Payton (TPCHD) at (206)591-6533, or Michelle Pirzadeh (EPA) at (206)553-1272 or (800)424-4EPA. EPA cannot advise or support homeowners who wish to implement cleanup actions on their own, but it is noted that the placement of clean soil over an exposed area serves as a cap to reduce potential exposure.

In addition, homeowners can obtain information about soil sample results in the vicinity of their homes in order to determine if they are in an area that is likely to require remediation, i.e., exceeds EPA's action levels for arsenic or lead. Soil sample results information can be obtained by contacting Mary Kay Voytilla (EPA) at (206)553-2712 or (800)424-4EPA, or Bruce Cochran (Ecology) at (206)438-7349, by reviewing maps in the Proposed Plan or ROD documents, or by reviewing the Ruston/North Tacoma RI at one of EPA's information repositories (see Table 1).

Last summer, Ecology conducted a soil collection service to provide residents with a way of safely disposing of small quantities of soil or sod generated in the course of normal yard work. Ecology started the service again in Spring 1993. For more information contact Sherrie Hanson (Ecology) at (800)458-0920. *Some limitations and restrictions apply.*

7. COMMENT: Many commentors including the Town of Ruston suggested that the proposed time frame of 7 to 12 years for the implementation of remedial alternatives was lengthy, and that they would prefer that the time frame be reduced to a minimum. Several commentors stated that they would prefer that the proposed cleanup begin as soon as possible, expressing disapproval of any delays.

RESPONSE: It is clear from the responses at public meetings, and the letters that EPA has received on this topic, that residents of the community support shortening the remediation timeframe as much as possible. Some commentors have even suggested conducting the cleanup in the shortest period of time regardless of the increased noise, crews, traffic, and the general short term inconvenience to the community. EPA will make every effort to shorten the cleanup timeframe as much as possible. For example, efforts are currently underway to identify property owners within the Study Area for the purpose of requesting access for sampling. In addition, EPA believes that the prioritization of cleanup by zones, beginning with the most contaminated, will be the most efficient way to proceed (see Section 9.7 of the ROD).

8. COMMENT: The Washington Environmental Council (WEC) expressed the concern that EPA's Proposed Plan is well designed but does not go far enough to protect public health.

RESPONSE: EPA addresses each of the WEC's specific concerns in this Responsiveness Summary. EPA believes that its selected remedy represents a comprehensive strategy and is protective of public health.

9. COMMENT: The WEC commented that cadmium contamination should be addressed.

RESPONSE: As a result of a screening level evaluation for contaminants of concern conducted in the risk assessment, arsenic and lead were selected as the two contaminants of primary concern for human health in the Study Area. Metal soil contaminants other than arsenic and lead (including cadmium), however, have been very carefully considered. Although cadmium levels do exceed normal background amounts in some sampled areas, estimated potential exposures and risks from cadmium do not appear to be significant. It is also worth noting that due to the high correlation of arsenic, lead, cadmium, and several other smelter related metals, physical remediation measures to reduce exposures to one contaminant will be substantially effective in reducing exposures to the others.

10. COMMENT: The Town of Ruston requested that a detailed and complete survey of the Town's roads and sidewalks be completed prior to any remediation work. The Town also requested participation in the development of a transportation plan for the remedial activities.

RESPONSE: EPA understands and acknowledges the Town's concerns regarding possible damage to roads and sidewalks during the course of conducting remedial activities. EPA has responded to these concerns in Sections 9.9 and 9.17 of the ROD. EPA believes that the development of a transportation plan is essential to establishing local truck routes to minimize disruption to the community. EPA expects to continue to involve the community, including the Town of Ruston and the City of Tacoma, as plans for the cleanup progress.

All properties subject to cleanup as well as roads and sidewalks will be surveyed and inspected prior to remediation activities to establish existing conditions. All possible precautions will be taken during remediation to avoid damage to these properties. Items damaged as a result of remediation activities will be repaired or replaced to the extent practicable.

f. Preliminary Action Levels

1. COMMENT: Several commentors expressed concern about the discrepancy between EPA and Ecology action levels. Several commentors wondered what a property owner could do with soil that is above state cleanup levels but which remained after EPA's proposed cleanup.

RESPONSE: Based upon EPA's risk assessment, EPA and Ecology have agreed that engineering actions (soil removal and replacement) should be taken on properties or areas where soil exceeds 230 ppm arsenic. The State's MTCA, however, establishes a cleanup level of 20 ppm arsenic in soil (the background or expected level of arsenic in urban soil). In order to meet the state's requirement, CPMs will be implemented in the Study Area where concentrations exceed 20 ppm but are less than 230 ppm. These measures will primarily be educational and geared toward making people aware of residual risks, reducing exposures to remaining contamination, and minimizing the residual risks and impacts of exposure should it occur. Soil removal and replacement actions will not be required for these properties.

Currently, under the Washington State Dangerous Waste Regulations (DW Regs), soil with more than 100 ppm arsenic and exceeding 220 pounds in quantity is considered to be a dangerous waste and requires disposal at a hazardous waste facility. The nearest hazardous waste landfill is in Arlington, Oregon. It is unrealistic to expect individuals to transport and pay for disposal in Oregon. Local landfills, however, have been reluctant to accept Study Area soils for disposal. There are two efforts underway to alleviate this disposal problem. Ecology is reestablishing a collection service for small quantities of soil and sod generated during normal yard work activities. Ecology is also evaluating a petition by Asarco to exempt residential soils from the disposal requirements in the Dangerous Waste Regulations. If granted, the exemption could modify disposal requirements, and could make the action level and the requirements for stringent disposal measures the same at 230 ppm arsenic. Soils with levels below 230 ppm could be disposed of using less stringent, but environmentally sound, methods. In the meantime, EPA suggests that homeowners store soils until the collection service is available or remediation begins (see response to comment 6 in Section 2e for more information on Ecology's soil collection service). EPA recommends that if homeowners must dispose of soils, they do so in a manner that will prevent other individuals from exposure to possible contaminated soils, or from spreading contaminated soils to other areas.

2. COMMENT: Several commentors expressed concern about properties with soil just slightly below action levels, which would not be removed despite the fact that adjacent properties with slightly higher concentrations would have the soil removed.

RESPONSE: EPA has used the results of the RI and the Field Investigation Report (FIR) to identify areas most likely to exceed the selected action levels. Prior to any remediation activities, additional sampling on a lot-by-lot basis will be required to confirm the presence of arsenic and lead above the action levels. These samples will be used to determine if a cleanup is needed on any individual property or area, including subportions of a yard. EPA has determined action levels for soil cleanup based on its assessment of protectiveness and other factors and has included in its preferred remedy CPMs that will apply to properties with soil contamination below those action levels but above urban background levels. EPA recognizes that individual views on risk will vary within the community. Individuals with concerns over potential exposures from soils with contamination below the action levels should find the CPMs of particular interest and should be attentive to the recommendations for minimizing potential exposures.

3. COMMENT: Several commentors thought EPA action levels were too high. One suggested 100 ppm for arsenic and 200 ppm for lead. The WEC suggested 20 ppm for arsenic and 250 ppm for lead, as required in the State MTCA, and expressed concern at the agencies' apparent failure to comply with applicable, relevant, and appropriate requirements, including MTCA.

RESPONSE: EPA has provided extensive information in the Proposed Plan and ROD, and other supporting documents, on how it selected its action levels and why it believes that performance of the cleanup action based on the selected action levels is protective. EPA and Ecology do not agree with WEC that MTCA requires action levels (i.e., levels that determine when soil is removed from a property) based on 20 ppm arsenic and 250 ppm lead (see Section 6.8 of the ROD). EPA believes its selected remedy complies with MTCA through the combination of engineering measures where the action levels are exceeded, and the CPMs Program.

g. Property Issues

1. COMMENT: Several commentors, including business people and homeowners, stated that or asked whether property values and marketability would be diminished due to the contamination, the publicity, and/or the proposed removal action.

RESPONSE: EPA directly addressed issues relating to property values and marketability through an extensive outreach effort in 1992 (see "Informational Fact Sheet for Property Owners, Lenders, Brokers, Realtors, and Appraisers" available by contacting Michelle Pirzadeh of the EPA at

(206)553-1272 or (800)424-4EPA). EPA believes that its outreach strategy was generally successful, as difficulties in selling/buying property and in obtaining financing prior to the performance of the cleanup in the Study Area appear to have been substantially reduced. It appears likely that implementation of EPA's selected remedy will substantially relieve remaining concerns about property values and marketability.

2. COMMENT: Several commentors stated that or asked whether the availability of financing would be diminished due to the contamination, the publicity, and/or the proposed removal action. One commentor stated that at least three area banks will not lend money to finance property in the shaded area on EPA's map (which indicates properties with contamination most likely to exceed action levels - see Figure 2.

RESPONSE: EPA does not expect the availability of financing for property transactions to diminish during cleanup of the Study Area. EPA believes that cleanup is a positive step and may in fact enhance property values. EPA has taken steps to address the difficulties some people have had in obtaining loans for property transactions within the Study Area (see response to comment 1 above in this section). Although EPA believes its efforts have been successful, there may be financial institutions that are reluctant to grant loans in the Study Area because they lack information about EPA's liability policies. In those cases, EPA will continue to provide information to lenders about cleanup plans and liability. EPA encourages citizens who experience problems to contact Mary Kay Voytilla (Project Manager) or Tod Gold (Site Attorney) at EPA for more information at (800)424-4EPA.

3. COMMENT: The Town of Ruston asserted that the "red lining" of the Study Area by financial institutions had resulted in the inability of property owners to obtain financing, and that this has resulted in hardship.

RESPONSE: The Town of Ruston submitted this comment during the first public comment period (February 17, through April 17, 1992). Since that time EPA has worked with the Town, the City of Tacoma, and Ecology to address the problem of financial institutions denying loans within the Study Area. After conducting some information-gathering activities to learn more about the specific concerns of lending institutions, outreach activities were conducted to provide information about EPA's preliminary cleanup plans and EPA's policies on lender liability and liability for residential homeowners. Also see response to comment 1 in this section above.

EPA used the outreach activities to educate people that the agency considers Asarco responsible for cleanup costs and does not intend to hold residential homeowners or their lenders liable for those costs. Specifically the outreach activities included (1) a joint seminar held on June 18, 1992 co-sponsored by EPA, the Town of Ruston, the City of Tacoma, and Ecology on the subject of property transactions for realtors, appraisers, banking professionals and legal counsel who conduct business in the Study Area, (2) a brochure for property owners, realtors, appraisers, and lending professionals on EPA policies toward liability for residential homeowners and lenders, (3) letters to federal lending agencies (i.e., Fannie Mae, Freddie Mac, FHA, HUD) describing EPA's policies, and (4) discussions with professional associations (i.e., Tacoma Pierce County Board of Realtors, Multiple Listing Service, Association of Mortgage Brokers, etc.)

EPA believes that these activities were successful. Banks in the area are granting loans for property transactions in the Study Area in most cases. If property owners or prospective buyers are denied a loan simply because the property is within the Study Area, EPA is willing to work with the lender and/or owner/buyer to provide additional information about cleanup plans and liability policies (see response to comment 2 in this section above).

4. COMMENT: One commentor stated that the fact that EPA is communicating information on the specifics of the cleanup does not suffice to make banks lend to property owners in the area. However, one commentor encouraged EPA to contact the property transactions community to mitigate the adverse impacts on property values and marketability. Another commentor said it would be

reassuring to members of the community if EPA kept them informed on what contacts have been made and their status.

RESPONSE: EPA intends to continue such activities as long as necessary, including maintaining regular contacts with representatives of the real estate community. EPA will keep Study Area residents aware of its activities through distribution in the community of periodic fact sheets and other publications that summarize such contacts. (See also response to comment 3 above on EPA's outreach activities on property values and marketability).

5. COMMENT: One commentor stated that potential home buyers do not remain interested in purchasing within the Study Area when they learn about the soil contamination.

RESPONSE: Although this may be true of some potential home or property buyers, it is not true of all. EPA personnel have met with representatives of the lending and real estate industries to provide information on issues of lender and homeowner liability. Real estate transactions continue within the Study Area, and property values in general appear to be rising.

6. COMMENT: Several commentors stated that they had recently purchased homes in the area and had not been informed of the contamination or the proposed cleanup.

RESPONSE: It is unfortunate that some new homeowners have purchased property without knowing that it was within the Study Area. Although there is not currently any mechanism to notify potential buyers about the soil contamination in the Study Area (other than sellers or real estate agents), EPA's ROD calls for some educational measures that would serve this purpose, specifically a data base (see Section 9.10 d of the ROD). The data base will contain sampling results for each property that has been sampled, as well as information on any cleanup actions that have been taken and the existing condition of the property. The data base will be available to the general public, but also to local government agencies and real estate agents. This will allow a real estate agent or prospective purchaser to look up sample results and any cleanup actions taken for a property in the Study Area as part of a property sale.

7. COMMENT: One commentor wanted to know if EPA could recommend an across-the-board property tax cut for the area.

RESPONSE: Taxes on property is a matter determined by state and local governments. EPA generally does not make determinations or provide recommendations on property taxes.

h. Sampling and Sampling Results

1. COMMENT: Many commentors expressed interest in having their soil sampled, while others stated they preferred not to have sampling done.

RESPONSE: Additional sampling, with permission from the property owners, will be required to determine the individual properties at which cleanup will take place. Surface and depth samples will be taken at properties within the shaded area that are most likely to have contaminants that exceed the selected action levels (see Figure 2). Additional samples will be taken at the request of the property owner at properties within the Study Area, but outside of the shaded area on Figure 2. If a sampled property in this latter category is identified as exceeding action levels, sampling will also be conducted at contiguous properties. In addition, ERA sites will be sampled to a depth of 18 inches below the existing soil caps. Prior to any sampling activities, EPA will seek access from the property owner via a signed access agreement. EPA hopes to work cooperatively with the property owners to acquire access for sampling, as well as to conduct any necessary cleanup actions.

2. COMMENT: Several commentors requested that people living outside the shaded area (see Figure 2), particularly those very near the border of the shaded area, have their soil sampled. The

Town of Ruston suggested that all schools, parks, and playgrounds within the Study Area, and not just the shaded area, be sampled.

RESPONSE: EPA intends to request access to sample all properties within the shaded area. In addition, properties outside of the shaded area but within the Study Area will be sampled at the request of property owners. EPA agrees with the suggestion offered by the Town of Ruston, and it has been incorporated into the ROD (see Section 9.1 of the ROD).

3. COMMENT: Several commentors noted that their property was between two sampling locations that suggested different conclusions. One commentor expressed concern that two samples equally distant from her property showed very different concentrations of lead, and that additional lead sampling may be necessary.

RESPONSE: Although there are generally observable patterns and trends in the data (e.g., concentrations decrease as you move away from the smelter, and concentrations generally decrease with depth) both arsenic and lead concentrations can vary over short distances. These variations are generally due to actions of individual property owners, such as tilling, landscaping, and filling, which disturb or cover the original soils and can result in changes in surface concentrations within a given area. EPA intends to conduct additional sampling for both arsenic and lead on a property by property basis.

4. COMMENT: One commentor asked if lead-contaminated areas had been addressed and separately mapped to account for possible sources of lead other than the smelter.

RESPONSE: Figure 4-22a of the RI and Figures 2-4 and 2-5 of the FS provide surface soil concentration and kriging maps for lead. Although far fewer samples were analyzed for lead than for arsenic, EPA found a high, statistically significant correlation between the two metals; i.e., where arsenic was found at elevated concentrations, lead was also generally found at elevated concentrations. EPA acknowledges that lead sources other than the smelter may exist. At those properties where lead levels above the action level, and arsenic levels below the action level may be found, EPA will make attempts to determine if another source of lead possibly exists, other than the smelter, prior to taking cleanup actions.

5. COMMENT: One commentor suggested that sampling of soil and house dust particles of less than 150 microns in size (which stick to the hands most readily) would be a relatively reliable sampling method for assessing risk.

RESPONSE: There are studies that suggest particles of smaller sizes do adhere to hands more readily than larger particles. (However, it should be kept in mind that these studies were done using dry soils and that particles of larger sizes from wet or damp soils would be expected to adhere readily to hands and other body parts.) Site-specific data demonstrate that arsenic concentrations in soil and dust increase as particle size decreases. As discussed in the uncertainty Section of EPA's Risk Assessment for the Study Area, one of the uncertainties in the risk estimates that EPA made is that exposures were calculated using samples screened to several millimeters and do not completely consider particle size. This would tend to underestimate the risks that were calculated.

6. COMMENT: One commentor noted that the concentrations of arsenic and lead near the foundations of homes may be 5 to 20 times greater than found in the midyard samples because of building surface accumulation and washdown. Another commentor asked if this had been considered in selecting sampling locations. One commentor asked if a detailed analysis to select the best method of sampling the individual properties had been conducted. Sampling design considerations mentioned by the commentor include: sampling on the windward versus leeward side of buildings; the effect of washdown from trees; and, for newly constructed homes, the effects of regrading and redistribution of shallow surface soils should be addressed.

RESPONSE: Section 2 of the RI contains detailed information on how the soil sampling locations were selected. In general, sample locations were selected in order to meet one of the following identified data needs: to increase the confidence in the data (a geostatistical analysis was done to identify sampling locations that would achieve this objective); to fill data gaps near and beyond the Study Area; to gain information about nonresidential soils and sediments including dirt roads, alleys, storm drains/catch basins, and parking lots; and to identify concentrations at depth.

Once the "general" sample locations were identified, a field check was conducted to identify specific sample point locations. No samples were collected from within the boundaries of ERA sites. Wherever possible, owners who had requested that samples be taken from their properties were accommodated. In addition, EPA spoke with property owners to determine if the owners had knowledge of any activities such as grading or filling that would disqualify the site from sampling. Some modifications to the planned sampling locations were necessary based on discussions with homeowners. In general, samples were collected from the main part of the yard and away from buildings and other structures. One sample was purposefully collected from an area near a rain gutter. This sample was elevated in relation to surrounding surface soil samples taken from other "non-drainage" areas.

During remedial design for the implementation of the selected remedy, EPA will determine the specific locations for sample collection to determine if a property needs to be cleaned-up.

7. COMMENT: One commentor suggested that the "holes" in the shaded area may be due to a large amount of fill put in place to fill a gully, and that contaminated soil may remain underneath.

RESPONSE: The "holes" in the shaded area represent areas of generally lower arsenic concentrations surrounded by higher arsenic levels (see Figure 2). The commentor's suggestion may be true for the area located between 48th and 49th Streets; i.e., a large vacant lot or lots. The other area (between 47th and 48th Streets) is largely the Baltimore Playground, part of the Metropolitan Park District. Both areas will be resampled as part of the remedial activities.

8. COMMENT: One commentor wanted to know whether EPA would sample all the alleys in the Study Area. The Town of Ruston requested that unpaved alleyways and roadways within the Study Area be sampled as part of the remedy, not just by request.

RESPONSE: The shaded area shown in Figure 2 identifies the area with contamination most likely to exceed action levels based on soil samples, including samples taken from unpaved roads and alleys. Samples taken from unpaved roads and alleys were generally lower in arsenic content than residential surface soil samples taken in the same vicinity. Vehicular tracking, surface water transport, and imported road subbase material may in part account for the lower arsenic concentrations in the unpaved street samples. EPA appreciates the commentors' concerns regarding the sampling of unpaved roads and alleys, but does not believe that current information justifies mandatory sampling of all unpaved roadways within the Study Area. These sampling services (within the Study Area but outside of the shaded area) will be offered, however, upon request.

9. COMMENT: The Town of Ruston asked how a sampling database will be created, maintained, accessed, and updated.

RESPONSE: EPA has identified the development of a property-specific data base as a component of the CPMs Program (see Section 9.10 of the ROD). As the cleanup progresses, information regarding sample results and completed cleanup activities will be entered into the data base. EPA hopes that the data base will become a widely used tool for individuals who need or want information regarding sampling and cleanup activities on specific properties. The specifics about developing, accessing, maintaining, and updating the data base will be further defined during the remedial design phase of the project, but EPA offers the following general requirements. The data base must be easily accessible, centrally located, and updated frequently. Both the Town of Ruston and the City of Tacoma need to be able to access information in the data base, as well as individual citizens. Other potential users, such as real estate personnel and lending institutions, need to be identified and avenues for access created. Educational efforts will need to be taken to inform people about the existence of the data base and its use.

10. COMMENT: One commentor suggested that there be additional sampling following the stack demolition in case of recontamination by dust.

RESPONSE: Additional sampling will be required on a property by property basis to determine if a property or area has soil that exceeds the action levels and therefore requires cleanup.

I. Soil Disposal

1. COMMENT: One commentor expressed preference for permanent smelter-site storage of contaminated soil. Several commentors, however, opposed smelter-site disposal, for reasons including the stigma of remaining contamination, health effects, and wetlands and water impacts.

RESPONSE: EPA's ROD for the Ruston/North Tacoma Study Area calls for appropriate off-site disposal of contaminated soil that will be excavated from the Study Area. At this current time, this means that the soil would be taken to a landfill and not the smelter site for disposal.

This ROD however, does not preclude EPA from making a future decision to dispose of contaminated materials (i.e., demolition debris, smelter site soils, or Study Area soils) at the smelter site in the future. An on-site containment facility is one of several options being considered in the FS for the smelter. After Asarco completes the FS, which will contain a detailed evaluation of all options, EPA will publish a Proposed Plan for public comment. The Proposed Plan will outline the agency's preferred alternative. Any proposal to contain wastes on the smelter site will be subject to a separate public review and comment process in the future.

2. COMMENT: The Town of Ruston commented on EPA's proposal to provide for a transfer station or temporary storage facility during cleanup. The Town suggested that as soil is removed, it be taken to its final destination, and commented that having a transfer site would allow greater exposure and result in unnecessary expense.

RESPONSE: EPA believes that a transfer station will be a necessary component of the remedy. The transfer of materials will be required because many streets throughout the Study Area cannot easily be accessed by the large vehicles that will be used to transport removed soils to the disposal location. EPA understands the Town's concerns and notes that the transfer station is not intended to serve as a long-term storage facility.

3. COMMENT: Several commentors expressed concern over the disposal of soil removed from their own yards, if their samples showed levels of contaminants above the state's action levels. Some of these commentors expressed that they felt penalized and wondered whether they were expected to bear the cost of disposal.

RESPONSE: Ecology is evaluating a petition from Asarco to exempt residential soils from the disposal requirements in the Dangerous Waste Regulations. If granted, the exemption could modify disposal requirements, and could make the action level and the requirements for stringent disposal measures the same at 230 ppm arsenic. Soils with levels below 230 ppm could be disposed of using less stringent, but environmentally sound, methods. The exemption would likely extend to beyond the Study Area to include other areas influenced by the Asarco smelter. Also see response to comment 1 in Section 2f above.

As part of the CPMs Program in the ROD, a soil collection service will be made available for those individuals needing to dispose of soils contaminated with more than 230 ppm arsenic. Homeowners will not be expected to pay for this service. In addition, Ecology is offering a soil collection service to residents of the Study Area this spring and summer for small quantities of soil or sod generated in the course of normal yard work. Also see response to comment 6 in Section 2e above.

4. COMMENT: The Town of Ruston stated that the cleanup plan should provide for the disposal of any contaminated soil that is generated as a result of breaching any cap put in place.

RESPONSE: EPA agrees. Under the ROD (Section 9.10), the disposal service will be made available for small scale homeowner activities, development activities, and local maintenance and repair projects.

5. COMMENT: One commentor expressed the preference that wastes with arsenic above 100 ppm be disposed at a hazardous waste facility.

RESPONSE: The response to comment 1 in Section 2f above discusses the current disposal requirements for arsenic contaminated soil under the DW Regs. The response also notes that Asarco has applied for, and the State is in the process of reviewing, an exemption to the DW Regs for arsenic contaminated soil from the Ruston and Tacoma area. EPA believes that Ecology's final decision on disposal of contaminated soil will provide adequate safeguards for the protection of human health and the environment.

6. COMMENT: One commentor wanted to know if the soil disposal would simply move the contamination problem to somewhere else.

RESPONSE: The selected disposal facility will be required to comply with all relevant local, state, and federal laws governing the disposal of contaminated material. These efforts will ensure that soil contaminated above action levels is kept away from contact with people.

j. Miscellaneous

1. COMMENT: One commentor stated that, as a tree farmer, he is partial to preserving topsoil that he stated requires hundreds of years to generate.

RESPONSE: Topsoil, as the commentor noted, requires a very long time to be produced. If existing topsoil must be removed because of contamination, a comparable layer of clean topsoil will be placed over a subsoil base to compensate for removal of the original topsoil.

2. COMMENT: Several commentors wondered whether, in the future, new data or new policy decisions would render the proposed cleanup either insufficient or unnecessarily extensive.

RESPONSE: EPA does not foresee any circumstances that would require already cleaned-up areas to be re-cleaned since replacement soils on remediated properties will not exceed background concentrations of arsenic and lead (20 ppm and 250 ppm, respectively). EPA believes that even lower values for the replacement soils are possible, especially for lead, e.g., lead less than 100 ppm. It is possible, however, that additional areas within and beyond the Study Area would undergo cleanup activities if future sampling identifies soil that exceeds the action levels. Also see the response to comment 14 in Section 2d above.

3. COMMENT: One commentor stated that she disagrees with the Superfund law, which she believes should be changed.

RESPONSE: EPA recommends that commentors who have suggestions to improve or change the Superfund law contact their representatives in Congress. During debate in Congress on reauthorization of the Superfund program, revisions to the law can be made.

4. COMMENT: One commentor indicated that it is important that the public perceive the area as safe, and cautioned that safety and the perception of safety do not necessarily go hand-in-hand.

RESPONSE: EPA agrees. Based on comments received from residents of the Study Area, EPA developed five general principles and guidelines that represented features to the community that were important if a significant cleanup were to be implemented. Two of these principles and guidelines are particularly relevant to this issue: (1) minimize the need for long term legal or administrative measures on individual properties, and (2) reduce uncertainties for homeowners.

By sampling individual properties and involving homeowners in the cleanup process, EPA believes that it can reduce or eliminate the uncertainties regarding health and safety issues that continue to plague many individuals. In addition, based on existing soil samples, EPA believes that under the selected remedy only a very small subset of properties will require property specific institutional controls following implementation of the remedy; i.e., have soil arsenic or lead concentrations above action levels at depth. EPA hopes to apply discretion in those areas where contamination above the action levels exists just slightly below 18 inches. EPA believes that this action will not only ensure the health and safety of the residents, but also allow the public to perceive the area and their neighborhood as being safe.

5. COMMENT: One commentor asked if EPA had checked ceramic dishes and plumbing as possible sources of metal exposures.

RESPONSE: In general, EPA does not evaluate dishes or plumbing through the Superfund program. EPA's investigation of lead was limited to sampling residential yard soils. It is possible that some exceedances of the 500 ppm soil lead action level may occur in the Study Area unrelated to releases from the Asarco smelter. Some property-specific determinations may be required to decide on the inclusion or exclusion of such areas as part of site remediation. EPA recognizes that exposures to lead from various routes are additive. The approach used to assess potential soil/dust lead exposures includes applying a general parameter (the Geometric Standard Deviation value within the EPA's Integrated Uptake/ Biokinetic Model for lead, described in the Baseline Risk Assessment Report) that represents the typical variability across a population in lead exposures. To some degree, that parameter already includes variable lead exposures from everyday sources such as plumbing or ceramic dishes, although extreme levels of exposure from such sources are not reflected. Therefore, it is possible that any individual with a high blood lead level has significant contributions from one of the sources cited by the commentor.

6. COMMENT: One commentor wondered why vegetable and flower plants were healthy if there was indeed soil contamination.

RESPONSE: Garden vegetables and plants do not appear to consistently uptake significant quantities of arsenic and/or lead. Some plants are more sensitive than others to specific contaminants like arsenic. The effects of soil contamination can therefore be a change in plant species present as well as signs of plant distress (e.g., lack of germination or growth). An Ecological Risk Evaluation (SAIC, July 1992) for the Study Area reviews the available information on potential plant effects of soil contamination.

7. COMMENT: One commentor asked if there is any slag on the non-deeded alleys in town.

RESPONSE: As far as EPA is aware, no inventory of slag use has ever been taken within the community.

8. COMMENT: One commentor asked if the former Everett smelter site was safe, and if any analogies could be drawn between the two areas. The commentor stated that some people had lived on the former smelter site for 45 years and were exposed to 230,000 ppm arsenic.

RESPONSE: Ecology has issued an enforcement order to Asarco to conduct interim cleanup activities at the Everett Smelter/Slag site, and to perform an RI and FS to determine the final cleanup action plan. Ecology is primarily concerned about levels of arsenic, lead, and cadmium in soils around residences. About 60 residences, located on fill directly over the site of the former smelter, are affected. The Everett smelter site is similar to the Ruston/North Tacoma Study Area in that potential exposures from ingestion of soils/dusts, with arsenic and metals contamination from smelter releases, is the primary concern at both sites.

Interim cleanup actions, determined necessary by Ecology to reduce the chance of people coming in contact with contaminated soils, include: paving exposed roadways and parking areas; adding gravel to driveways; covering areas of exposed soil in yards; and removing and replacing garden soils. These actions, which were initiated last year, affect about 29 residences.

The soil contaminant concentrations at the Everett smelter site include some very high values, as noted by the commentor. However, health studies of the relatively small number of people potentially exposed by soil ingestion at the Everett smelter site would in EPA's opinion likely be too limited in statistical power to be useful in examining risk estimates for either that site or the Ruston/North Tacoma Study Area.

9. COMMENT: One commentor expressed that when EPA was asked difficult questions, they did not answer, or the answers were not understandable.

RESPONSE: EPA regrets that this commentor did not get sufficient and/or understandable answers to his questions. EPA has taken significant steps to explain the process and its activities to the community (see Section 3.0 of the ROD for a detailed description of community relations activities). There are many difficult questions and issues associated with cleanup of the Study Area and EPA has tried to address them. If at any time, citizens have additional questions about EPA's activities, EPA encourages them to call the local community liaison located in Ruston at (206)759-1321, or the project team in Seattle toll free at (800)424-4EPA.

10. COMMENT: One commentor indicated that the change of EPA project manager three times in the past two years resulted in inefficiency.

RESPONSE: EPA respectfully corrects the commentor on this issue: there are four project managers at EPA who are responsible for managing different, but related, Asarco projects (see Section 4.0 of the ROD for a description of the four Asarco-related projects). Mary Kay Voytilla has been the EPA project manager for the Ruston/North Tacoma Study Area (the focus of this ROD and Responsiveness Summary) since May of 1990, except for a six month period (May to October, 1992) when she was on maternity leave.

11. COMMENT: One commentor expressed concern that some EPA representatives had, in actively soliciting public comment, encouraged citizens to undermine or question EPA's own authority, and that this went beyond public education.

RESPONSE: EPA believes that is was successful in involving the public in the decision making process, not just informing them of the process. Under the Superfund program EPA seeks to involve citizens in the process of selecting the best cleanup remedy for a site. EPA believes that community involvement is most important at a site such as the Study Area because the selected remedy will have an impact on many private citizens.

EPA acknowledges that members of the public have challenged EPA's assumptions and conclusions on the cleanup. Such comments are not unexpected given the magnitude and impact of the cleanup on the community. EPA has made a considerable effort to respond to such comments in a clear and well-reasoned manner, and to modify its cleanup plans based on such comments where appropriate.

EPA agrees that its actions during the two public comment periods went beyond public education. From EPA's perspective, the level of public involvement in the process to select the remedy has resulted in a better remedy for the citizens in the Study Area.

12. COMMENT: One commentor noted that in the past, when fallout from the smelter damaged cars, boats, or other property, Asarco would pay claims for damages. This commentor suggested that Asarco remain responsible until all damages to property had been corrected.

RESPONSE: Under the Superfund law, Asarco is liable for costs associated with cleanup. Actions for damages to property, such as cars or boats, must be brought by individual citizens under other legal theories, such as trespass or nuisance.

13. COMMENT: One commentor asked about the probability of Asarco blocking or substantially delaying the cleanup plan. One commentor expressed concern as to whether Asarco would assume responsibility for cleanup outside the smelter site, and how timely such action would be. This commentor suggested that Asarco should promptly indemnify neighboring property owners for contamination. This commentor noted a lack of response in personal communications with Asarco personnel, and expected Asarco to delay action.

RESPONSE: EPA will decide whether and how Asarco will implement the cleanup. If Asarco conducts the cleanup, EPA will oversee the work to ensure that it is performed in a timely and satisfactory manner. Under the Superfund law, EPA does not have the authority to require Asarco to indemnify property owners for damages. Also see response to comment 14 directly below.

14. COMMENT: One commentor expressed concern that Asarco's financial, public relations, and legal "muscle" had an adverse effect on the agencies' willingness and ability to stand behind their statutory authority.

RESPONSE: EPA has made an independent evaluation of the need for and scope of remedial actions in the Study Area. EPA's evaluations for this site included careful consideration of comments from the public and from Asarco, as required under the NCP. EPA does not believe its decision has been adversely influenced by Asarco comments or actions throughout the process leading to adoption of a ROD for the Ruston/North Tacoma Study Area. EPA is committed to the performance of the Selected Remedy described in the ROD. EPA will either perform the cleanup itself or ensure that Asarco dedicates the necessary financial, public relations, and legal resources to perform the cleanup in a timely and satisfactory manner.

3. ASARCO COMMENTS AND EPA RESPONSES

EPA received comments from Asarco during both of the public comment periods. EPA responded to some of Asarco's comments submitted during the first comment period in a separate letter which is included as Attachment 2 of this Responsiveness Summary. The remainder of Asarco's comments submitted during the first comment period, as well as their comments submitted during the second comment period, are addressed in this section. Comments are grouped below in the following categories: a) Preferred Cleanup Plan, b) Remedial Investigation, c) Feasibility Study, d) Risk Assessment and Risk Related Issues.

a. Preferred Cleanup Plan

(Responses to some comments submitted by Asarco on the Proposed Plan will also be found below in Section 3d, Risk Assessment and Risk Related Issues).

1. COMMENT: Asarco stated its hope that the public will review the details of the cleanup plan and consider the impacts that the soil removal will have over the next several years.

RESPONSE: EPA received significant public comment on the Proposed Plan in the form of letters, and input during community meetings. EPA has carefully considered all public comments and believes that the selected remedy incorporates community input to the greatest extent possible. It should also be noted that public comment weighed heavily in the identification of the preferred alternative that was put forth in the Proposed Plan (see the Proposed Plan sections F and K). EPA intends to continue working closely and cooperatively with community residents as the remedy is implemented.

2. COMMENT: Asarco stated that the most important project underway is the cleanup of the smelter site.

RESPONSE: EPA agrees that the smelter site cleanup is important. The residential soils cleanup, however, is also important. EPA notes that the Study Area represents an existing residential community with confirmed soil contamination leading to potential long-term exposures. Asarco has previously commented that there is little potential for ongoing contaminant transport from the smelter property to the surrounding community; exposures to community residents are therefore determined largely by the existing soil contamination within the Study Area. EPA has devoted considerable energy to developing, identifying, and selecting a cleanup plan for the community and coordinating these efforts with the community, local governments and Asarco. EPA hopes to continue working in a spirit of cooperation with all parties to implement the selected remedy.

3. COMMENT: Asarco commented that the public's frustration with the agencies' complicated and confusing regulatory process is understandable.

RESPONSE: EPA has taken significant steps to explain the Superfund process and its activities in the Study Area to the community (see Section 3.0 of the ROD for a detailed description of community relations activities). More importantly, EPA has provided many opportunities for citizens to not only learn about the process, but be involved in it. EPA recognizes that there are citizens who are frustrated and who may not fully understand the process but, based on the level of public involvement during the two public comment periods, EPA believes that its communication efforts have been effective.

As the ROD is implemented there will continue to be opportunities for citizens to be informed and involved in cleanup activities (see Section 9.16 of the ROD). EPA recognizes, however, that some citizens cannot attend meetings and workgroups to learn more about the process. Therefore, an important component of implementing the cleanup will be to work individually with owners of property that will require cleanup. This will insure that individual homeowners have input into how cleanup is accomplished on their property.

4. COMMENT: EPA has inappropriately discounted Asarco's views because of its status as a potentially responsible party (PRP). Furthermore, Region 10 has apparently decided to ignore the results of public opinion polls performed for Asarco by Elway Research, Inc. It is arbitrary and capricious for EPA to reject the results of community polling because Asarco commissioned them.

RESPONSE: EPA has not discounted Asarco's comments. All of Asarco's significant comments have been considered and addressed and some have resulted in modifications to the

Selected Remedy. Responses to all comments raised by Asarco can be found in this Responsiveness Summary document.

EPA has carefully reviewed the results of the public opinion poll, and the reply cards and letters that were mailed to Asarco in response to the Asarco Community Update newsletter. The poll results and the reply cards and letters were submitted to EPA by Asarco during the Proposed Plan public comment period. The comments relevant to the residential soils project have been addressed in this responsiveness summary. In addition, the survey results, reply cards, and letters have been included in the Administrative Record for the Ruston/North Tacoma site along with all other comments received on the Proposed Plan (see Table 1 for the locations of EPA's Administrative Records).

Nonetheless, EPA believed that it was vital to hear concerns directly from the residents of the Study Area -- the people that have been impacted by the contamination and that will be affected by cleanup activities -- through public meetings and written comments. Asarco's financial stake in the outcome of EPA's decision making on this site is too substantial for EPA to reasonably rely only on Asarco's surveys to objectively evaluate community concerns.

5. COMMENT: Design and implementation of an appropriate sampling plan is crucial to the implementation of the alternative. The sampling plan must provide information that will allow for flexibility in removals. A sampling plan keyed to the Proposed Plan was submitted to EPA by Hydrometrics on behalf of Asarco. The plan is based in part on Hydrometrics' work on the residential cleanup in East Helena, Montana.

RESPONSE: During the preparation of this Responsiveness Summary and the ROD, EPA has been evaluating alternative approaches for sampling and analysis of individual properties within the Study Area to reach property-specific decisions about the need for remedial actions. The sampling approach submitted by Asarco during the Proposed Plan public comment period has been included in these evaluations.

EPA has considered a number of performance criteria for evaluating sampling and decision rule alternatives for when remedial action would be taken at a property or area. The following principles guided EPA's evaluations: (1) the approach should be protective of human health; (2) it should be increasingly stringent as the level of contamination increases; (3) it should be cost-effective, balancing the costs for sampling and analysis with the potential risks of failing to remediate properties where warranted, or spending remediation dollars unnecessarily on cleanup actions where soil is below the defined action levels; (4) it should address community concerns about soil contamination, for example the identification and remediation of "hot spot" areas within yards; and (5) it should minimize the possibility for any remaining contamination so that the need for long-term institutional controls on individual properties is reduced.

EPA has performed numerous statistical analyses of the performance of a large number of alternative approaches for sampling and decision rules, using performance measures related to the above principles (see Design Analysis for Ruston/North Tacoma Operable Unit Residential Soil Sampling, ICF Technology Incorporated, June 1993, and Identification of the Preferred Soil Sampling Approach and Decision Rule for Ruston/North Tacoma, ICF Technology Incorporated, May 10, 1993.). The available Study Area soils data were considered in performing these analyses. A detailed Sampling Plan will be developed as part of final remedial design efforts. However, based on its completed evaluations, EPA has identified a preferred approach for sampling properties in the Study Area and determining the need for remedial actions. That approach involves the use of 4:1 composite soil sampling at various depths within subareas of a property. The number of subareas can vary depending on the total size of exposed areas (excluding structures or paved areas) at a property, with between three and six subareas per property. EPA anticipates working with each property owner or resident to identify appropriate sampling locations at a property. Decisions on soil remediation will reflect a two-part rule: (1) if the average soil concentration for a property exceeds the action level for either arsenic or lead, the entire property will be cleaned up, with the depth for remediation determined by the depth-interval sampling results; and 2) even if the average soil concentrations do not exceed action levels, subareas of the property (defined by the soil compositing approach) will be remediated if they individually exceed either of the action levels.

This approach for sampling properties in the Study Area and determining the need for and scope of remedial actions is supported by analyses showing it to be both protective of human health and cost-effective. It also largely addresses the concerns raised by Ecology and community residents for remediation of "hot spots" within a property. Where it differs from current EPA guidance, for example the guidance recommending use of the statistically-determined upper confidence limit (UCL) on the average concentration in risk calculations (see OSWER Publication 9285.7-081, May 1992), its performance is supported by the detailed analyses completed by EPA. While a UCL-based decision rule is very protective, it results in remedial actions at a large number of sites with soil concentrations below the action levels. EPA's preferred approach has also been shown to minimize the amount of soils remaining in the community above action levels after completion of the cleanup actions, and thereby reduces the need for long-term institutional controls on individual properties.

6. COMMENT: The Proposed Plan recognizes that an 18 inch removal on each property should not be required. An 18 inch removal at every yard would be inconsistent with the 12 inch removals approved by EPA at the Bunker Hill, Globe, and East Helena sites.

RESPONSE: EPA does not propose to remove soils to a depth of 18 inches at every property. The Selected Remedy allows for flexibility in the amount of soil that is removed. Depth samples will be taken at each property to determine the extent of contamination and the level of excavation required, but will not in general exceed a maximum depth of 18 inches. Based on current depth profile sample data, EPA believes that the majority of property cleanups can be accomplished with an excavation depth of only 6 inches. Based on those same data, EPA estimates that only 15 percent of the properties will require excavation to 18 inches. Some portion of these properties will have contamination remaining below 18 inches. The additional excavation at these properties, i.e., to a depth of 18 inches, will eliminate the need for long-term property-specific community protection measures on individual properties.

Both the Globe site and the Bunker Hill site include excavation or replacement of greater than 12 inches of soil (18 and 24 inches, respectively) in certain areas.

7. COMMENT: The Proposed Plan states that EPA will consider the need for additional sampling outside of the Study Area. It is not clear what criteria EPA will use in its evaluation, or whether such an evaluation is part of the Ruston/North Tacoma residential soils cleanup. The Proposed Plan does not show a need for such an additional evaluation.

RESPONSE: As stated in Section 4.1 of the ROD, the selected remedy applies to only those properties or areas located within the Study Area, as well as the three areas located directly to the south of the Study Area, where RI or FIR sample results show that soil exceeds the action levels. Available data suggest that contamination above background concentrations, and possibly exceeding the action levels, exists beyond the Study Area. See Section 4.3.1 of the RI for a further discussion of the possible extent of contamination beyond the Study Area. EPA will evaluate the need for further sampling and appropriate cleanup activities outside of the Study Area separately from the current action, and at a later date.

8. COMMENT: Asarco agrees with EPA that scheduling of any yard remediation by zone would promote maximum efficiency. There are no public health considerations justifying singling out discrete segments of the population for priority treatment, and doing so would unnecessarily prolong the disruption of the community as a whole.

RESPONSE: As stated in Section 9.7 of the ROD, EPA expects that the Study Area will be divided into manageable zones for remediation. The cleanup of properties will generally proceed within an area at a time, beginning with the most highly contaminated areas. EPA believes that this is not only the most efficient method for cleaning up properties, but that this strategy will be the least disruptive to the community overall. Mobilization and the movement of cleanup teams can be scheduled and managed efficiently using a zone system.

At times, EPA may find it necessary and justifiable to take action at select properties or to prioritize cleanups within a zone in order to more effectively implement the overall cleanup of the Study Area. EPA, therefore, does not preclude the possibility for selective removal, but would seek to proceed with the remediation using the zone system to the greatest extent possible. For example, within an area or zone, priority may be given to schools, parks, playgrounds, daycares, homes with children, or other areas where children tend to gather. Children are of special concern because their typical behaviors, like playing outdoors and various hand-to-mouth activities, may result in exposure to soil contamination. Children are also particularly at risk for some effects of exposure to metals, especially lead.

9. COMMENT: Procedures for homeowner access and approval must be designed so that cleanup can move forward expeditiously while adequate records are created. Asarco included examples of remediation procedures that have been used successfully at the Bunker Hill and East Helena Superfund sites.

RESPONSE: EPA agrees with Asarco. Provisions for both "homeowner access and approval", as well as "community relations during cleanup" have been included as separate components of the Selected Remedy (see Sections 9.14 and 9.16 of the ROD). EPA hopes to draw upon both the agency's and Asarco's experiences at other residential cleanup sites in working with homeowners and residents within the Ruston/North Tacoma Study Area.

10. COMMENT: Use of the "general principles and guidelines" skews the nine criteria so that they cannot be used for an objective analysis of alternatives as required by the NCP, the regulatory framework for the Superfund program. It is inconsistent with the NCP to pre-assess community concerns prior to the close of the public comment period, and to use that assessment to drive the balancing of the primary criteria.

RESPONSE: EPA disagrees with Asarco's characterization of the selection process. EPA has evaluated the range of alternatives and selected a remedy based upon all of the NCP's nine criteria as documented in the Proposed Plan and the ROD. The "general principles and guidelines" were based on public comments received from the community on the FS. EPA believes that these general principles and guidelines represent features that were important to the community if a significant cleanup action were to be implemented. EPA identified these principles in the Proposed Plan to make it very clear that "community acceptance," one of the nine criteria, was being considered seriously by EPA.

Although § 300.430(e)(9)(iii)(I) of the NCP states that "community acceptance" may not be completed until comments on the Proposed Plan are received, the preamble to the proposed NCP clearly provides that comments from the community are taken into account throughout the RI/FS process (53 Fed. Reg. 51429, December 21, 1988). The preamble to the final NCP confirms this policy by encouraging the involvement of the interested public through all stages of the cleanup process (55 Fed. Reg. 8767, March 8, 1990).

11. COMMENT: The higher cost of the Preferred Alternative does not result in significantly more benefits than Alternative 3, and is not cost-effective as defined under Comprehensive Environmental Resposne, Compensation, and Liability Act (CERCLA) and MTCA, the federal and state hazardous waste cleanup laws, respectively.

RESPONSE: The primary reason EPA selected a cleanup alternative that involves extensive soil removal is that it will be the most effective over the long-term in protecting human health. At most properties, the potential for exposure to soil posing a significant risk, i.e., soil above action levels, will be eliminated. If the contaminated soil is too deep to be removed (deeper than 18 inches), an 18 inch soil cap will be placed over the contaminated soil.

In contrast, Alternative 3 involves covering of contaminated soil with sod caps, which are far more easily breached than an 18-inch soil cap. Sod covers can fail -- increasing the potential for exposure to contaminated soil -- when dry conditions exist and watering is restricted, or when extensive development activities are implemented. Such activities reasonably could include establishing or relocating an unsodded gardening area or children's play area or regrading a yard. Failure of sod covers are much more likely than failures of 18-inch soil caps, i.e., the protectiveness and long-term effectiveness of a cap increases as the thickness of the cap increases (see also response to comment 3 in Section 3d below).

In addition, after receiving Asarco's comment, EPA reevaluated Alternative 3 to determine what would be required to make Alternative 3 as effective as the Selected Remedy; i.e., what measures would be required to prevent or substantially minimize contact with contaminated soil beneath the sod cap. This analysis is important because preventing or reducing the potential for exposure of residents to contaminated soil is the best measure of the protectiveness of a cleanup in the Study Area.

Several comprehensive measures would be required to ensure that sod caps do not significantly erode or fail (or that such failures are repaired quickly) so that residents would not be exposed to the contaminated soil remaining under the sod cap. EPA believes that the following measures would be necessary to make Alternative 3 nearly as effective as the Selected Remedy. EPA does not believe that Alternative 3 could ever be as effective over the long-term as the Selected Remedy because of the impossibility of ensuring complete compliance with these requirements at the more than 500 properties that are estimated to require cleanup.

Under Alternative 3, a comprehensive system of monitoring, maintaining, and repairing the sod caps would need to be implemented and enforced to ensure that failures of the sod cap either did not occur or were repaired immediately. The soil collection/disposal and permitting programs would have to be substantially larger than under the Selected Remedy to accommodate the contaminated soil that has not been removed during cleanup but which may be excavated in the future as the result of routine yard work and development and building projects. Education efforts to remind current residents and to inform future residents of the continued existence of contaminated soil in the Study Area would also be much more extensive under Alternative 3 than under the Selected Remedy.

Under Alternative 3, since very little of the contaminated soil would be removed, all of the properties requiring cleanup would be subject to the ongoing measures related to sod cap maintenance and future excavation/disposal of contaminated soil beneath the sod cap.

The re-estimated cost of Alternative 3 is shown in a memorandum prepared by Bechtel dated May 1993 entitled "Revised Cost Estimates For The Selected Remedy And Alternative 3 At Ruston/North Tacoma, Washington." The re-estimated cost of Alternative 3 to include the additional requirements described in the paragraphs above is $36 million, as compared to the estimated cost of $24 million shown in the FS (both estimates assume nonhazardous disposal of soil excavated in the future).

Under the Selected Remedy, contaminated soil above action levels will be completely removed from most of the properties requiring cleanup. EPA expects that only a small number of properties will still have contaminated soil beneath a soil cap. Accordingly, only a minimum number of properties will require ongoing measures to ensure the continued integrity of the cap and to address future excavation and disposal of contaminated soil below 18 inches. Once the Selected Remedy has been completed, most of the owners and residents involved will be able to enjoy use of their property subject only to general community-wide guidelines on handling soil.

It should be noted that the Bechtel memo referenced above also reanalyzed the cost of the elements of the CMPs program under the Selected Remedy. The estimated cost of the Selected Remedy has modestly increased from $60 to $62 million (nonhazardous disposal).

Asarco further contends that the Selected Remedy is not cost-effective. Under EPA's definition of cost-effective, EPA compares the incremental difference in cost between alternatives to the incremental difference in effectiveness. A higher-cost alternative can be considered cost-effective if the added effectiveness provided is not disproportional to the added cost.

In the above analysis, EPA has compared the cost of the Selected Remedy to the cost of Alternative 3, modified to be as effective as possible over the long-term at protecting human health as the Selected Remedy. Although the estimated $62 million cost of the Selected Remedy is greater than the estimated $36 million cost of Alternative 3, EPA believes that the difference in cost is not unreasonable given the projected amount of contaminated soil that must be addressed by the cleanup and the significant difference in protectiveness over the long-term that would be attained by the Selected Remedy. Accordingly, EPA has determined that the Selected Remedy is cost-effective (see Section 10.3 of the ROD for additional discussion of cost-effectiveness).

12. COMMENT: It is not clear that a Trust Fund for "ongoing activities" would be authorized under CERCLA.

RESPONSE: EPA has modified the Selected Remedy to state that a funding mechanism will be established for the CPMs Program and educational requirements. EPA believes that these activities are an integral part of the remedial action to address hazardous substances in the community and are not inconsistent with the NCP. Accordingly, the costs of these activities would be costs authorized under § 107 of CERCLA. The appropriate funding mechanism will be established when it is determined whether EPA or Asarco will implement the cleanup action.

13. COMMENT: EPA has no legal authority to compel a PRP to repair and maintain public highways used by remediation vehicles.

RESPONSE: EPA believes that Asarco would be responsible to the Town of Ruston or the City of Tacoma for negligent or illegal (e.g., excess weight) usage of roads and highways during the cleanup.

14. COMMENT: Asarco expressed the opinion that removal of contaminated soil from alleys and parking areas followed by replacement with clean gravel would be superior to asphalt capping. The soil removal and gravel replacement option would be more cost effective and permanent than asphalt capping.

RESPONSE: EPA recommended asphalt capping in the Proposed Plan because it would provide a relatively impermeable barrier that would reduce or eliminate the potential for contact and transport of contaminants. As stated in Section 11.0 of the ROD, EPA has reevaluated the Proposed Plan requirement for asphalt paving of dirt alleys and parking areas exceeding the action levels. The two approaches (asphalt capping versus soil removal and gravel replacement) are similar in terms of their overall protectiveness. The primary difference between the two approaches is the need for the long-term maintenance of asphalt caps that are underlain by contaminated soils. The ROD, therefore, allows for dirt alleys and dirt parking areas that exceed action levels to be either capped with asphalt to provide a relatively impermeable barrier to contaminants, or for the contaminated soil to be removed and replaced with clean gravel. In Section 11.0 of the ROD, several criteria are discussed which will be evaluated in determining which option to implement.

15. COMMENT: Asarco expressed the opinion that scheduling removal from manageable zones is highly desirable. However, removal from select residences that may be targeted for various reasons (i.e., households with children) must be avoided to the extent possible. A systematic block by block

soil removal schedule facilitates the most efficient use of equipment and labor. It also removes the potential for citizens to perceive that removal operations are conducted preferentially or in an inconsistent manner.

RESPONSE: See response to comment 8 in this section above.

16. COMMENT: Asarco suggested that, while it is necessary to cover trucks during the transport of contaminated materials, lining is not necessary and would be expensive and time consuming. Also, loading of trucks would be done in a manner that would minimize the accumulation of contaminated material on the outside of trucks or the wheels. A combination of water trucks and street sweepers could be used to maintain streets used by trucks in a clean condition.

RESPONSE: There are several reasons for lining trucks during transport; however, the ultimate specification of safety measures will be determined during remedial action design. EPA believes that lining provides several advantages. The physical condition of the soil throughout the site is unknown and if there are portions that are very wet, lining would prevent free drainage from the trucks onto public roadways. It is unreasonable to assume that water trucks and street sweepers would be effective in controlling contamination on high speed highways. In addition, federal Department of Transportation (DOT) regulations define the actions that must be taken to protect the public with regard to the interstate transport of wastes. The transportation method selected by the contractor for remediation can affect the need for liners; e.g., steel roll-off containers may not need liners but, in many cases, even rail cars require liners to stop leaks. EPA recommends liners as a low-cost safety measure that can ensure wastes are not accidentally distributed along the path of transportation.

17. COMMENT: Asarco expressed the opinion that, based on the RI report, Ruston soils are not a threat to groundwater and the need for a "relatively impermeable barrier" is not justified. Also, typical activities associated with alley-way traffic would not necessarily result in more contact on a gravel cap area than on an asphalt cap.

RESPONSE: EPA expects leaching of contaminants from Ruston soils to be negligible (as noted in the comment) so an asphalt cap would not be needed to prevent leaching. The asphalt cap was not intended as a means to prevent infiltration; rather, it would eliminate the generation of dust containing arsenic and lead from exposed or compacted gravels and soils. As noted in the response to comment 14 in this section above, either asphalt capping, <u>or</u> soil removal and gravel replacement will be implemented for dirt alleys and dirt parking areas that exceed action levels.

18. COMMENT: Asarco expressed its concern that, due to frequent heavy rains in the winter months, a 10-month construction season assumes the absolute best-case scenario, which is not consistent with a realistic approach to constructability evaluations. The assumption of an 8-month annual construction season is more realistic. Conservatively, a 6-month annual construction period is possible and should be considered in a sensitivity analysis. A time frame based on a 6-month period may be more likely in Ruston considering previous experiences at the ERA sites. Accordingly, it seems reasonable to expect that the actual time for completion of excavation work will exceed 7 years.

In addition, given that there are effective alternatives available for the protection of human health and the environment that can be completed in much shorter time frames, the selection of the Preferred Alternative appears to be inconsistent with the intent of MTCA to require a reasonable remediation time frame.

RESPONSE: The 10-month construction schedule was selected based upon reasonable assumptions regarding the ability of contractors to perform the relatively common paving, excavation, removal, and revegetation work. EPA appreciates Kennedy/Jenks Consultants' experience in performing construction management in the Tacoma area and recognizes that adverse climatic conditions can delay the progress of remediation activities. EPA remains confident that the remedial action time schedules presented in the FS and Proposed Plan are achievable. Remediation activities will include a variety of operations, some of which (e.g., surveying, sampling, mapping, field sample data analysis and interpretation) can be performed year-round. Efficient planning and construction management, as well as the use of additional resources when necessary, can effectively combat project delays and schedule slippage. The 7-year time frame for remediation represents the time for removal of the maximum estimated volume of soil and is reasonable under MTCA. (EPA notes that MTCA does not explicitly set forth maximum deviations for remedial actions.) Lot-specific sampling will ensure that only contaminated material in excess of cleanup goals is removed, so the total volume removed may be less than the current estimates. Together with efficient implementation of the remediation, this should ensure that remediation is completed within or near projected timeframes.

19. COMMENT: Asarco expressed concern that any alternative involving excavation will violate ARARs, as the acceptable arsenic air emission level in the State of Washington is extremely low (Class A Toxic Air Pollutant with established Acceptable Source Impact Levels (ASILs) cited in WAC 173-460-150) and is likely to be exceeded through any excavation activities. This emission level has been used by Ecology as a standard applicable to disposal of incinerator ash (WAC 173-306) and has been specifically cited by Ecology as a standard for landfilling of soils from Ruston/North Tacoma (see 10 August 1992 Tentative Decision Document, Asarco Petition to Exempt Ruston Residential Soils from Washington Dangerous Waste Regulations). Alternative 3, which involves capping of contaminated soils, will minimize dust generation and runoff concerns.

RESPONSE: The acceptable arsenic level for industrial sources of pollutants identified in WAC 173-460-150 is extremely low (0.00023 $\mu g/m^3$) as noted in the comment. (EPA also notes that the ASIL is more than an order of magnitude below typical background concentrations.) It is, important to review the entire WAC 173-460 and identify the types of sources and facilities for which WAC 173-460-150 was developed. Upon review of the code, it is clear that the ASILs cited in 170-460-150 were developed for industrial sources of pollutants, and no reference or mention is made to the application of such standards to CERCLA sites or any sites that may undergo remediation activities. Within the code, provision is made for procedures to be followed to obtain exceptions to the ASILs from Ecology. Moreover, the application of the ASILs by Ecology to incinerator ash does not have any direct impact on decisions regarding soils excavated at Ruston. The waste components, characteristics, toxicity, and handling methods are not comparable. Nor is the proposed application of ASILs by Ecology to the landfilling of Ruston soils directly applicable to the excavation of the soil. WAC 173-460 identifies ASILs as applying to landfills, but does not include application of the ASILs to the excavation of soils from CERCLA sites.

EPA also notes that the tilling of soils associated with the implementation of Alternative 3 is also likely to have short term ambient air impacts (see discussion of Alternative 3 in Section 7.4 of the ROD).

20. COMMENT: Asarco expressed the option that the fact that "EPA believes that the alternatives involving soil removal, including the Preferred Alternative, will be more effective and permanent over the long-term than alternatives that do not require extensive soil removal," does not by itself provide any compelling basis for selecting an alternative that is excessively costly and disruptive to the community. The only way to judge reliably whether the incremental cost increase of a given alternative is justified in terms of the risk reduction afforded by that alternative is to do so on the basis of a realistic quantitative evaluation of risk reduction. Asarco suggested that legal measures and protective barriers would be effective and would be less costly than soil removal.

RESPONSE: See response to comment 11 in this section above.

21. COMMENT: Asarco expressed concern that implementation of the Preferred Alternative would diminish the quality of life in the Ruston/North Tacoma community for years. Residents would be asked to accept the constant nuisances of traffic, noise, air pollution, and a blighted landscape (created by incessant construction activity), in the interest of effecting a health risk reduction that could be accomplished by implementing much less disruptive measures. Excavation equipment and

constant truck traffic will pollute the community with noise and engine exhaust, and create accident hazards that would not normally be present.

RESPONSE: EPA believes that the continued presence of elevated levels of contaminants at the site represent a significant potential health risk to members of the community that must be mitigated. Moreover, EPA believes that the health risk reduction due to implementation of the Selected Remedy would be substantially greater over the long-term than that from other Alternatives presented in the FS. Varying levels of disruption to the community are unavoidable during remediation of excessive levels of contaminants. Because remedial action will probably be performed on a zone-by-zone basis, individual neighborhoods within the community are not likely to be encumbered by ongoing remedial activity over the course of the cleanup. Rather, cleanup will occur in an area, be completed, and the remediation contractor will then move to another area of the site. EPA is interested in adopting plans that can aid in the expeditious completion of the Selected Remedy and seeks to ensure the maximum practicable degree of safety to residents without undue disturbances to the community.

b. Remedial Investigation

(Responses to some comments submitted by Asarco on the RI will also be found below in Section 3d, Risk Assessment and Risk Related Issues).

1. COMMENT: Asarco commented that stating maximum concentrations of arsenic and lead in the Executive Summary of the RI was misleading, and that typical numbers were lower. Asarco also noted that a geometric mean may be more representative of typical values than an arithmetic mean when there is a high outlier.

RESPONSE: The Executive Summary statement concerning the maximum measured concentrations of arsenic and lead in the soils of the Study Area is accurate and is based on the extensive data of the RI and FIR studies (Tables 3-3, 3-4, 4-2 and 4-6, and Figure 3-1 of the RI). The average concentrations, either arithmetic or geometric, are lower than the highest values cited. The soil data for the entire Study Area appear to have a log-normal distribution. For lognormal distributions, the geometric mean value can be used to estimate the 50th percentile (median, or typical) value in describing the distribution (but see the comments below on risk assessment). The complete data set for soils, reflecting large variability across sampling locations, is presented and discussed within the RI Report text. That data set is also presented graphically (see, for example, Figures C-2 and C-3 in Appendix C of the Baseline Risk Assessment Report), in ways that make it easier to "see" the statistical distribution for the entire data set. The RI Report includes many maps showing the spatial variability in soil contaminant concentrations.

EPA notes that the statistical distribution of the entire soils data set is not useful for estimating individual exposures and risks. See the responses to comments 4 and 23 in section 3d, below, which address the issues related to the size of exposure units and the uses of soils data for estimating risks. Decisions on remedial actions at individual properties within the Study Area will be based on the results of additional sampling at each property being considered, and not on statistical averages of the entire Study Area data set or any substantial portion thereof.

2. COMMENT: Asarco asked whether the data used for review of possible trends were comparable with the FIR and RI data set. They asked about the sampling procedures and techniques and whether they are really comparable. They noted that Section 5 page 5-26 of the RI states considerable sample bias is possible in comparing different data sets for time trend purposes.

RESPONSE: Sampling procedures and techniques were nearly identical in the FIR study (Black and Veatch) and the RI study (Bechtel) as referenced in the FIR Sampling Plan (Appendix B, FIR, September 1988) and the RI Report (Section 2.1) and RI Sampling Plan.

The locations of the soil samples in the FIR and RI studies were as follows: (1) For the FIR, 23 critical high use areas within 0.5 miles of the smelter were sampled. For the remainder of the Study Area, samples were collected on a grid pattern at 250 feet or 500 feet intervals (FIR Sampling Plan); and (2) For the RI, soil sampling locations were chosen by four methods, each with a different purpose as presented in Subsection 2.2.1, page 2-3 of the RI, and shown on Figure 2-2 of the RI.

Because sampling locations in the soil studies conducted in different years are not equally representative of the entire study area (sampling location bias), time trend evaluations cannot simply compare the statistics (e.g., averages) of the data sets. Instead, separate analyses of surface soil arsenic concentration versus distance from the smelter were conducted for the data from each study and the resulting data plots (accounting for distance, but not necessarily direction components of potential location bias) were compared to assess possible time trends in soil contamination through 1990.

3. COMMENT: Asarco asked for an explanation of why only four depth samples were collected. They stated that some of the apparent trends of arsenic at depth may be a function of the soil chemical and physical property changes with depth, and asked if soil profile characteristics were compared.

RESPONSE: During the FIR in 1988, four locations were selected near the smelter to develop an initial profile of the depth of contamination. During the RI in 1990, a more extensive program of subsurface sampling included 63 sampling locations for the 6-inch depth. Twenty-three of these locations were also sampled at the surface and at the 12-inch depth. The last phase will be conducted when individual residential properties that may require remediation are sampled. EPA believes that this phased investigation approach to develop a profile of the depth of contamination is more orderly and cost effective than a single phase study because all previous data can be used to plan the next more-efficient investigation.

The analytical results in Appendix C tables of the RI Report present data on location, depth, total metals, leachable metals, pH, particle size, and size distribution of samples in order to discern soil profile characteristics in relation to these parameters.

4. COMMENT: Asarco asked about the correlations of the subset metals and stated that the calculated correlation coefficients should be presented. They asked how strong the "strong correlations" are.

RESPONSE: Pairwise linear scatterplots showing the correlations in concentrations for selected metals are presented in Figures 3-1 to 3-6 in the FIR Report (Black & Veatch, September 1988). Table 3-1 of the FIR shows the calculated correlation coefficients of other metals with arsenic and with each other. Seven other metals have correlations with arsenic greater than 0.586, with selenium and lead being the highest at 0.834 and 0.798, respectively; EPA considers these all to be "strong" correlations. Addition of the RI data for another 14 locations at which a suite of metals was analyzed does not substantially change the overall pattern of correlations among arsenic and other metals. In fact, using either parametric or nonparametric correlation methods, the pairwise correlations among arsenic and the other six metals included in RI analyses are all positive and significant at $p<0.02$, with most values at $p<0.0001$.

5. COMMENT: Asarco noted that all textural and pH data from this RI as well as the FIR data should be included in the RI report.

RESPONSE: Soils textural and pH data from the RI studies are presented on Table 3-7, Figure 3-4 and in Appendix C of the RI. These data are not available for the FIR studies by Black and Veatch.

6. COMMENT: Asarco asked for the results of XRF comparisons, and questioned what equipment and sample processing techniques were used.

RESPONSE: The results for the XRF comparisons are provided in the table below. A report of the results which identifies the sampling methods, instrumentation, and calibration procedures used is included as Attachment 1 of this Responsiveness Summary.

Ruston XRF Arsenic
Split Sample Results

	Arsenic Result (ppm)		
Field Sample Number	CLP-Lab Sample Number	XRF Value	CLP-Lab Value
90254867	5462J-456	---	86
90254868	5462J-457	---	209
90254869	5462J-458	---	68
90254870	5462J-459	---	206
90254872	5462J-461	---	25
90254873	5462J-462	---	169
90254874	5462J-463	450	454
90254876	5462J-465	2720	2900
90254877	5462J-466	410	476

"---" indicates a non-detect

7. COMMENT: Asarco commented that locations of non-residential sample sites may be included on Figure 2-1 of the RI, but they are not identified and cannot be distinguished from residential samples or other sample types. Asarco also commented that on first inspection, the figure gives the impression it shows all sample sites when, in fact, it does not show the majority of sampling locations that are part of the FIR data set.

RESPONSE: Figure 2-1 should be used in conjunction with Table 2-1 in order to distinguish non-residential samples from other samples. Figure 2-1 is clearly labeled "Remedial Investigation Sample Locations", which should be neither confusing nor misleading. Figure 4-3 depicts both FIR and RI surface soil sampling locations for arsenic.

8. COMMENT: Asarco asked about the criteria for selection of a different number of 6 inch samples and 12 inch samples.

RESPONSE: The rationale for choosing soil sample locations was based primarily upon the scenario of air-borne contaminants originating from the smelter stack and smelter fugitive emissions deposited on surface soils with concentrations generally decreasing with distance away from the smelter, and with depth at a given location. The limited leachability of heavy metals and their tendency to be tied up in the soil also would limit their movement after deposition. To efficiently and economically determine the extent of contamination, more samples were obtained at the surface and at shallow depths than at deeper depths. Thus, there are more RI samples at the 6-inch depth than at the 12-inch depth. During remediation activities, soils on individual properties of concern will be sampled to a maximum depth of about 18 inches.

The legend in Figure 2-1 of the RI, "Remedial Investigation Sample Locations" includes a distinction between surface, 6- and 12-inch depth soil samples as well as sample replicates. In addition, Tables 3-3, 3-4 and 4-4 summarize this sample depth information with respect to arsenic concentrations, priority pollutant metals concentrations, and depth profiles respectively.

9. COMMENT: Asarco commented that surface soil samples could be critical in ascertaining the significance of soil concentrations at depth. Without surface soil information, complexities associated with changing soil heterogeneity, and changing physical and chemical soil horizon characteristics (man made or natural) are difficult to interpret.

RESPONSE: Table 4-4 of the RI presents information related to 23 soil depth profile sampling locations. Three soil profile types were delineated with maximum arsenic concentrations at the surface (Type A), at the 6-inch depth (Type B) and at the 12-inch depth (Type C), respectively. In 43 percent of the sampling locations the soil profile was "normal" (Type A1) and there was no known man-induced profile disturbance. There was, however, evidence of man-induced profile disturbance in 39 percent of the total sampling locations, with Type B or C profiles. Thus in only 4 of the 23 cases was the depth profile distribution of arsenic difficult to interpret. EPA believes that information on possible disturbance of the soil profile is likely to be more important than characterization of soil properties at the surface in interpreting contaminant soil profiles that include contamination at depth.

10. COMMENT: Asarco inquired whether replicate samples were averaged as described in Section 3.2 of the RI when field or laboratory duplicates were outside of the quality control range.

RESPONSE: No replicates for arsenic or lead were outside the QC range. Therefore, the comment is not applicable to the key analyses from the RI.

11. COMMENT: Asarco commented that Table 3-3 and Section 3.2.1 of the RI are misleading and include only a portion of the data set. They stated that the entire data set should be presented and discussed as a whole, since that is the way it is used for later evaluations in this RI and in the FS. They added the following details: The description of the data set ranges is misleading. The maximum arsenic value of 2,900 ppm is from a sample that is not a residential yard, as suggested, and it is not a surface sample. The sample was collected from the stack hill on the east side of Baltimore Street about 100 feet from the stack. The next highest value in the "RI" data set is 980 ppm. In addition, this value was collected at a depth of 6 inches. It is not representative of typical soil values in residential areas and is not a residential site sample. Typical average soils are significantly lower (see Comment 1 in this section above).

RESPONSE: Table 3-3 lists, in descending concentrations of total arsenic and in 4 separate categories (e.g., surface soil samples), the test results for 222 samples (including 13 replicate samples) obtained at 163 locations during the RI investigation. Similar data are presented on Table 4-2 for the 288 FIR samples (including 8 subsurface samples and 15 replicate samples, but not 14 Quality Assurance/Quality Control (QA/QC) blank samples) obtained at 265 locations. EPA does not believe that these data are misleading in any way.

It was not suggested that the maximum arsenic value of 2,900 ppm was from a residential yard but rather the RI stated "...sample RNT465, collected at the 6-inch depth at the northern end of the Study Area near the Asarco smelter stack,..." and no mention of a residential yard was made nor implied. The location of sample RNT465 is clearly shown on Figure 2-1 of the RI. It is also obvious that sample RNT465 is not a surface sample as it was clearly stated that it was a 6-inch depth sample (see text quote above). EPA does not believe that the description of the data set is misleading either in the text "...maximum of 2,900 ppm...to a low of 1.9 ppm..." or on Table 3-3 or 4-2 of the RI.

The next highest value in the RI data set is not 980 ppm or collected at a depth of 6-inches as stated in the comment but rather 981 ppm (RNT512) and a surface sample as clearly shown in the text and on Figure 2-1 and Appendix C, respectively. The text and Table 3-3 show sample RNT512 as nonresidential, so it could not possibly be misinterpreted as being "...representative of typical soil values in residential areas..." as stated in the comment. Average soil values are always lower, by definition, than the highest and next highest arsenic concentrations in the data set listed on Tables 3-3 and 4-2. See the response to comment 1 in this section, above, for comments related to the overall statistical distribution of the soils data set versus the use of soils data in the risk assessment.

In summary, EPA believes that the brief summary of these data in RI section 3.2.1 is not misleading, but clearly stated. That discussion simply provides an overview of the RI data set. The evaluations of the combined FIR/RI data set are provided in section 4 of the RI Report.

12. COMMENT: Asarco commented that page 3-8 of the RI states a general trend of finer grain size with depth in the soil profile. This grain size relationship could be a factor in some of the deeper soil profile arsenic concentrations that were observed.

RESPONSE: The relationship between fines (the silt and clay fraction of the sample) and the depth of the sample is shown on Table 3-7 of the RI. Although soil grain size and contaminant concentrations could be related, no strong correlations were discerned from the RI data. The soil washing treatability studies conducted as part of the FS indicated some relationship of concentration versus particle size, especially contrasting the finer and coarser size fractions, but the results overall did not suggest that particle size effects were strong enough to account for most of the depth profile data.

13. COMMENT: Asarco questioned whether available background concentrations, taken at 0-3 inch depth, are comparable to RI data taken at 0-1 inch depth.

RESPONSE: EPA notes that the Exposure Pathways Study, which provided some data used for the urban background evaluations (including samples from Bellingham, Washington), in fact collected samples from the 0-1 inch depth interval. EPA believes that available local urban background data on concentrations of arsenic and lead in the near-surface soils are broadly comparable to the RI data in terms of characterizing the extent of contamination related to former smelter activities. Table 4-7 of the RI compares the soil concentrations of selected priority pollutant metals in the Study Area to local and regional/nationwide values. Urban background levels considered most relevant for the Ruston/North Tacoma area are 20 ppm for arsenic and 250 ppm for lead and are based on the assessment of several data sets, including the Exposure Pathways Study data from 0-1 inch. Comparing these background levels with the action levels of 230 ppm for arsenic and 500 ppm for lead, action level/background ratios are about 12:1 and 2:1 for arsenic and lead, respectively. Considering these ratios, EPA believes that comparing background soil samples collected from 0-3 inch depths with RI samples collected from a 1 inch depth is acceptable. EPA also notes that soil action levels for the Study Area are not based on estimated background concentrations.

14. COMMENT: Asarco commented that a statement on page 4-6 of the RI is inconsistent with the conclusions of the Fate and Transport section that lead levels are unlikely to decrease in area soils.

RESPONSE: The statement on page 4-6 that "urban lead levels may have declined somewhat in recent years as a result of lower gasoline lead content" refers to a possible reduction in a background source of soils contamination. The statement on page 5-29 of the Fate and Transport Conclusions in the RI that "the decrease over time in soil concentrations (of arsenic and lead) from current levels is expected to be quite low" refers to an in-situ soil condition. The first statement concerns an input source and the second statement concerns a fate and transport output; these statements refer to different situations and thus are not inconsistent. Changes in soil lead levels after re-equilibration following the gasoline lead phase-down (or the cessation of smelter operations) are expected to be slow. Recent soil lead monitoring in the FIR and RI studies took place several years after the shutdown of smelter operations and the cessation of smelter lead emissions.

15. COMMENT: Asarco responded to a statement on page 4-14 of the RI, that spatial variability is typical, based on soil investigations of other locations.

RESPONSE: Spatial variability is to be expected in soil sampling and the results must be evaluated using geostatistical methods, such as kriging, that are applicable; this is certainly the case at the Ruston/North Tacoma site.

16. COMMENT: Asarco commented that the areal extent of elevated concentrations in subsurface soils is significantly less than that in surface soils.

RESPONSE: The spatial variability of arsenic and lead concentrations, even at the scale of a single residential lot, has resulted in a need to sample and test each individual property in the area of concern to determine if action levels are exceeded. Individual lot sampling will include collection of samples to determine the depth of contamination at that lot.

17. COMMENT: Asarco stated that chemical and physical soil profile characteristics should be considered when attempting to interpret soil depth concentration relationships and causes.

RESPONSE: This comment is addressed in this section above in the responses to Comments 9 and 12. The Appendix C tables present the chemical and physical soil characteristics that were considered in evaluating soil depth profiles for arsenic and their likely causes. Absent physical disturbance of a soil profile, EPA believes that the depth profiles for smelter-related contamination reflect the air deposition pathway (i.e., to surface soils) and the relatively low mobility (leaching potential) of arsenic and other metals in the Study Area soils.

18. COMMENT: Asarco inquired whether the maximum arsenic values of 3,000 ppm and 2,900 ppm had to be treated as statistical anomalies and removed from the data set used for the mathematical model in the RI.

RESPONSE: The maximum arsenic values of 2,900 ppm and 3,000 ppm were not removed from the data set used for the kriging model as stated on page 4-27, first paragraph: "None of the isolated higher values of arsenic were removed from the sample set." The kriging model looks at neighborhood values of arsenic concentrations (e.g., any anomalous values, either high or low, are smoothed over to produce a spatially adjusted statistical picture). EPA believes that it is important to retain all values that potentially reflect smelter-related contamination in the spatial analysis to provide a useful analysis of areas of impact. The only values removed from the kriging analysis were those reflecting areas of known recent soil replacement that are therefore not representative of smelter impacts on area soils (see RI Appendix E). See the response to comment 34 in this section, below.

19. COMMENT: Asarco stated that it is not appropriate to compare average values of one data set against median values of another data set as done on page 4-33 of the RI. Even within a given data set, arithmetic averages can be considerably different than the median. In these circumstances median values are more indicative of typical average numbers in the data set.

RESPONSE: EPA agrees that it is inappropriate to compare the mean values of one data set to the median values of another data set. The last sentence on page 4-33 of the RI is unclear and should be disregarded. The RI text on page 4-33 does include a statement comparing average Study Area concentrations of lead in surface soils to the estimated urban background average concentration current levels is expected to be quite low" refers to an in-situ soil condition. The first statement concerns an input source and the second statement concerns a fate and transport output; these statements refer to different situations and thus are not inconsistent. Changes in soil lead levels after re-equilibration following the gasoline lead phase-down (or the cessation of smelter operations) are expected to be slow. Recent soil lead monitoring in the FIR and RI studies took place several years after the shutdown of smelter operations and the cessation of smelter lead emissions.

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RESPONSE: EPA agrees that it is inappropriate to compare the mean values of one data set to the median values of another data set. The last sentence on page 4-33 of the RI is unclear and should be disregarded. The RI text on page 4-33 does include a statement comparing average Study Area concentrations of lead in surface soils to the estimated urban background average concentration of 250 ppm used in this study. Figure 4-25 of the RI also provides a graphical presentation of all of the data, in which the urban background value of 250 ppm is readily available for comparison.

20. COMMENT: Asarco noted that the coefficient of 0.798 of arsenic versus lead is statistically significant. This is particularly significant in evaluation of an approximately 41-acre area defined in Figure 2-5 of the FS which has low arsenic concentrations (less than 230 ppm) but high lead concentrations (above 500 ppm). Based on data presented in the FS, the 41-acre high lead/low arsenic area was delineated based on three data points with lead concentrations of 559, 687 and 768, respectively. In this area, arsenic and lead do not correlate well. If these three data points are removed from the overall data set, the calculated arsenic/lead correlation coefficient improves to 0.828. This suggests the slightly elevated lead concentrations in this area may not be related to smelter sources.

RESPONSE: Kriging to define the boundaries of the 41 acre high lead/low arsenic area shown on Figure 2-4 of the FS was based on 5 data points (not 3 data points; see Figure 4-22a of the RI) with surface lead concentrations of 527, 559, 687, 744 and 768 ppm. Because of the small number of samples (many fewer samples than for kriging of surface soil arsenic concentrations), the true extent of the area exceeding the 500 ppm action level of lead is problematic. For this reason, all properties considered for remediation will be sampled and tested to determine if the action levels for lead are exceeded. Thus, the 41-acre area serves as a guide for remedial actions, and this area as well as other areas of the site may or may not require remedial action depending on the results of lot-specific sampling.

The correlation coefficient between arsenic and lead has validity only when the data base is sufficiently large; it is in EPA's view improper to consider correlations of subareas containing only 5 data points. Subarea correlations should not be cited as favoring or discounting a smelter source for lead. EPA also notes that the five data points used to map the kriged area which is potentially greater than 500 ppm lead in surface soils actually had relatively high arsenic concentrations (even though much of that area was not included in the kriged areas above 230 ppm arsenic, because of nearby, lower arsenic values). The lead concentrations ranged from 527 to 768 ppm (as noted above); corresponding arsenic concentrations ranging from 113 to 356 ppm, with 3 of 5 values greater than 230 ppm. Thus, arsenic concentrations for the actual data points used are relatively high compared to urban background values. A major uncertainty with the kriged area of high lead values is therefore the small number of lead data points. It is possible that the five available data points for lead are relatively unrepresentative of the larger kriged area; arsenic values at other sampling locations are generally lower than at the five lead sampling sites (see Figure 4-3 of the RI).

EPA believes the smelter source of lead for this high lead/low arsenic area requires further investigation, including assessing the possibility of other urban sources for lead, and additional sampling, testing and evaluation of soils for lead and arsenic concentrations in the 41 acre area. EPA has the authority to take or compel remedial actions at the site that address current contamination from smelter operations and releases, but not similar contamination resulting from other sources.

21. COMMENT: Asarco stated the opinion that the high values cited for arsenic do not well represent the entire data set but represent isolated values nearest the smelter. Geometric average values should be presented as well as maximum and minimum values to present a better "feel" for the data.

RESPONSE: Statements citing the range of arsenic soil concentrations include the lowest values as well as the highest values (by definition) and exactly represent the range of values for the data set. Other statistical measures could have been given, such as geometric mean, arithmetic mean, median, or mode to provide other types of summary statements regarding data distributions. The RI Report has presented the complete soils data in a variety of formats (numerical and graphical) that EPA believes are appropriate and sufficient to convey an overall appreciation of the variability, both statistical and spatial, in the soils data set. EPA notes that 25% of the tests, as performed and reported, had arsenic concentrations greater than the selected action level for arsenic (see Figures C-2 and C-3 of the Baseline Risk Assessment, Appendix C).

22. COMMENT: Asarco stated that the first conclusion of Section 7.2 is misleading and implies significantly higher impacts than actually found. Results of the study show only 25 percent of the Study Area had arsenic concentrations above proposed action levels.

RESPONSE: The conclusion is a statement of fact and as such is not intended to be misleading, nor does it imply significantly higher impacts than those actually found. The RI Report states that arsenic, lead and other metals are found in concentrations in soil above background levels in the Ruston/North Tacoma Study Area; it does not mention nor does it imply anything about arsenic concentrations above proposed action levels.

23. COMMENT: Asarco stated that some of the higher lead values measured that are paired with relatively low arsenic values may be related to other non-smelter sources.

RESPONSE: The definitive word in the RI sentence is "largely" (not totally), which accommodates the anomalous high lead/low arsenic area that might have an origin other than the smelter. This comment is also addressed above in the response to Comment 20.

24. COMMENT: Asarco stated that only two samples in the RI had values above the proposed action level at depth.

RESPONSE: This comment is incorrect. As shown on Table 3-3 of the RI for total arsenic concentrations for soil samples at the 6-inch depth and 12-inch depth, the number of RI samples above the 230 ppm action level are 11 and 2, respectively; the number of FIR samples are 4 and 2, respectively (Table 4-2). Thus 19 soil samples out of the 94 samples obtained at depth, or 20 percent, were above the arsenic action level.

25. COMMENT: Asarco noted that while the statement at the end of the first paragraph of page 7-6 of the RI may be true for selected areas, other factors were apparently not considered including physical and chemical soil characteristics, and the possibility of soil imports with elevated metals.

RESPONSE: The statement in the RI is true for the selected areas presented on Tables 4-4 and 5-5. The physical and chemical soil factors were considered as shown in Appendix C. See the responses to comments 9, 12, and 17 in this section above. EPA continues to believe that based on all available information the overall pattern of soil contamination within the Study Area, including depth profiles, cannot be explained except by reference to smelter emissions and releases.

26. COMMENT: Asarco expressed its concern that the designation of soil sampling locations as "surface soil sampling locations identified by geostatistical analysis," "surface soil sampling locations in areas requiring additional data," and "non-residential surface soil and sediment sampling locations," often led to confusion in the discussion of investigative findings in terms of whether soil samples were, in fact, collected from surface soils and/or whether results were for residential areas, non-residential areas, or for all surface sampling locations.

RESPONSE: "Surface soil sampling locations identified by geostatistical analysis" are shown on Figures 2-1 and 2-2 and Table 3-3 of the RI. "Surface soil sampling locations in areas requiring additional data" are shown on Figures 2-1 (identified as "Data Gap" in the legend), 2-2 and Table 3-3. "Non-residential surface soil and sediment sampling locations" are listed on Tables 2-1 and 3-3 and shown on Figures 2-1, 4-2(a), and 4-2(b). These documents clearly show the different types of samples.

27. COMMENT: Asarco stated that the numbering of samples collected from 6-inch and 12-inch depths at the same locations did not facilitate interpretation of the results. Further, Asarco stated that

the two colors used to indicate the 401 to 800 ppm arsenic results/areas and the greater than 800 ppm results/area on a number of the most important data presentation maps, are difficult to distinguish.

RESPONSE: The numbering of samples collected from 6-inch and 12-inch depths at the same locations is presented on Figures 2-1 and 4-6, and listed on Table 3-3 and Appendix C of the RI. EPA considered it better to assign a unique number to each sample rather than a location modifier.

The color for the 401 to 800 ppm arsenic results/areas is orange and for the greater than 800 ppm is red as presented on the figures. Although the colors are close, EPA believes they are distinguishable. EPA regrets any inconveniences to the reviewer.

28. COMMENT: Asarco expressed concern that comparison of the arsenic concentrations in a composite surface soil sample with subsurface soil samples collected from discrete depths at one location within the same 400 square foot composite sampling area, will not necessarily provide an accurate representation of trends in the arsenic concentration profile from the surface to 12 inches below ground surface at the specific location where the subsurface samples were collected.

RESPONSE: EPA considers the samples to be representative of the soil profile of the 400 square foot sampling area, even though the composite surface samples are not necessarily representative at the specific point where the subsurface samples were collected within the 400 foot sampling area. Each individual lot of concern will be sampled in the future to determine if remediation is required, and at what depth.

Depth profile information for soil contamination in the Study Area is also available from a number of studies other than the RI. That information is reviewed in section 4.3.4 of the RI Report (Bechtel, January 1992). EPA believes that the results of all of these studies are generally consistent and support the interpretations made in the RI. When care has been taken to collect soil samples for depth profiles at undisturbed locations (e.g., in "Evaluation of the Movement of Arsenic, Cadmium, and Lead in Tacoma Soil Profiles", E.A. Crecelius et al., 1985, report to the Tacoma-Pierce County Health Department), contaminant concentrations have been found to decrease rapidly with depth.

29. COMMENT: Asarco suggested that Section 2.2.1 of the RI should provide some measure of the benefit added (increased certainty) by increasing the sampling density.

RESPONSE: The uncertainty associated with the sampling density shown on Figure 4-3 of the RI for total arsenic surface soil concentrations was determined by the results of kriging as presented on Figures E-9 and E-10, the 95 percent confidence interval, lower limit and upper limit, respectively. This is a way to provide a definitive measure of the benefit to be added by increasing the sampling density and thus increasing the level of confidence in the data.

30. COMMENT: Asarco noted that the text states "This suggests that soil samples from locations such as drains and unpaved streets may have slightly different physical or chemical characteristics from yard soil." It is not clear how this conclusion can be made based on the pH data presented. The data only indicate greater variability in the pH of surface soils at locations such as drains or streets, when compared to yard soil, not that the soils are necessarily any different in their general physical or chemical composition.

RESPONSE: This cautious statement, using phrases such as "suggests" and "may have slightly different" (characteristics) is not a conclusion but a hypothesis based on a range of pH values that was about one-half to one order of magnitude more than the other soil groups (Figure 3-4 of the RI). The text is not intended to imply that pH affects the physical characteristics of the soil.

31. COMMENT: Asarco expressed concern that it is not clear what bearing the variability of measured particle size distribution values for samples from the "non-residential surface soil samples

and sediment group," has on whether or not soils on a given street are physically or chemically similar to nearby yard soils.

RESPONSE: The typical greater range of percent fines of nonresidential soils (Table 3-7 and Figure 3-4) may indeed cause "slightly different physical and chemical characteristics from yard soils" as this hypothesis suggests. A slight increase in fines can markedly change the engineering classification, hydraulic conductivity, plasticity, or cation exchange capacity of a soil and affect the soils behavior.

32. COMMENT: Asarco inquired what means were used to attempt to identify extraneous contamination.

RESPONSE: EPA's assessment of the travel blanks and equipment blanks indicated that the soil samples delivered to the laboratory did not contain any extraneous contamination.

33. COMMENT: Asarco noted that the observation that arsenic concentrations may vary greatly over relatively short distances suggests that appreciable areas of soil containing lower arsenic concentrations (i.e., less than 230 ppm) are present within areas that have been statistically delineated as higher concentration zones (i.e., greater than 230 ppm).

RESPONSE: Figures 4-3, E-7, E-8 and E-11 of the RI show graphically that areas of arsenic concentration less than the action level of 230 ppm are present within areas that have been statistically delineated as higher concentration zones. This characteristic of high dispersion or variation between some sampling points accounts for the need to sample each individual lot in the area of concern in order to determine if remediation is necessary.

34. COMMENT: Asarco stated that designating only the isolated samples with "low levels of arsenic" as nonrepresentative and removing them from the data set used for geostatistical analysis, while leaving the isolated samples with higher arsenic concentrations in the data set, is a conservative approach that biases the outcome of the geostatistical analysis.

RESPONSE: Eight samples out of a total of 428 arsenic surface samples were designated as nonrepresentative (with respect to a smelter source) and removed from the data set used for the geostatistical analysis in order to minimize bias. These eight isolated samples with low levels of arsenic were attributed to known past non-smelter activities such as the addition of topsoil by a homeowner. The two isolated samples with higher arsenic concentrations were, in fact, likely the result of smelter activities, and so were not removed from the data set. It has been acknowledged in the RI (refer to response to the comment directly above) that areas with low levels of arsenic are present within areas that have been statistically determined to contain higher arsenic concentrations.

35. COMMENT: Asarco stated that the sentence that states "The bioavailability of arsenic to plants is generally proportional to the arsenic concentration of the soil" should be modified to say "... the <u>water extractable</u> arsenic concentration of the soil."

RESPONSE: EPA acknowledges that this modification of the sentence to read "The bioavailability of arsenic to plants is generally proportional to the water extractable arsenic concentration of the soil" is correct. This is already discussed in the second paragraph under <u>Plant Uptake of Arsenic</u> on page 5-12 of the RI.

36. COMMENT: Asarco inquired why soil ion exchange capacities were not measured in several representative samples to support what appears to be a logical conclusion that the area soils have relatively high arsenic absorption capacities.

RESPONSE: The levels of leachable arsenic in the Study Area soil samples, none of which exceed the regulatory limit of 5,000 µg/L, were determined by the leachability tests (Table 3-5 of the

RI). EPA considers this to be a very definitive test with respect to evaluating the relatively high arsenic absorption capacities of the area soils. In addition, the high iron content of selected soil samples in the Study Area was determined; iron oxides and iron hydroxides are very important in the sorption of arsenic (Table 5-5 of the RI). Ion exchange capacities are a gross measure and are not contaminant specific. EPA considered the leachability and iron content tests more important with regard to directly evaluating the movement of arsenic in the soils.

c. Feasibility Study

(Responses to some comments submitted by Asarco on the FS will also be found below in Section 3d, Risk Assessment and Risk Related Issues).

1. COMMENT: Asarco expressed its opinion that the detailed alternatives presented in the FS do not reflect existing conditions for the Ruston/North Tacoma area (e.g., Alternative 3 consists of sodding yards and pavement to reduce the potential of exposure to arsenic and lead in soils). Based on preliminary observations, it is likely that only about 10 percent of residential yards require the additional effort for a protective sod cap. Most residences in the Ruston/North Tacoma area have significant sod and vegetative cover. Sod capping of only the residential yards that do not have sufficient sod cover would significantly reduce the number of residences requiring remediation as part of this alternative, and significantly reduce costs associated with its implementation.

RESPONSE: In the FS, EPA evaluated several alternatives which could provide varying degrees of protection to human health and the environment. The alternatives were based on the best available information. Numerous site visits as well as sampling events were conducted. Conditions at the site are continually changing and therefore, what may be representative at the present time can be dramatically changed within a short period (e.g., consider the recent [summer and fall of 1992] construction activity within the Study Area related to new home building). This type of activity can result in redistribution of contaminants throughout the soil profile as well as resuspension of contaminants on dust particles. Dust generation may have been exacerbated during the unusually dry summer of 1992. These are but a few reasons why it is not possible to provide a completely accurate snapshot of current conditions at the site.

With regard to existing sod cover, the intention of Alternative 3 was to eliminate or reduce the potential for contact or exposure to contaminated soil at residential lots. EPA recognizes that some homeowners have maintained or recently established sod covers. However, the nature of contamination both below any existing sod as well as directly at the surface within the root mass is unknown. EPA anticipates that the implementation of this alternative would result in the generation of about 14,700 cubic yards of contaminated soil and lawn debris. The existing field data indicated that soil arsenic and lead levels at any of the approximately 525 homes within the proposed cleanup zone are more likely to exceed cleanup goals than be below cleanup goals. Thus, although sod may be present at some fraction of the homes, it is likely that soils below or directly incorporated in the sod may be contaminated and therefore the existing sod cover would be unacceptable. The maintenance of a seemingly healthy lawn cover does not preclude the presence of contaminants in the sod cover at levels in excess of the cleanup goals. A principal method for soil and lawn contamination was atmospheric deposition of particles and this form of distribution has been shown typically to result in an accumulation of contaminants directly on the surface. The comment that only 10 percent of the homes would require sodding is therefore not supportable based on the existing information. (Also see response to comment 3 in Section 3d.)

2. COMMENT: Asarco stated that although Alternative 4 consists of soil removal from 525 residential yards to a depth of one foot, based on kriging data presented in the RI (Figure 4-17), only 2 percent of the Study Area, or about 17 acres have soil concentrations in excess of the 230 ppm arsenic concentration action level at the 6 inch depth. This implies that a soil removal action for this alternative of 6 inches is more appropriate for the majority of the area within the proposed action limit area.

RESPONSE: EPA has reexamined this aspect of the data and has developed the Proposed Plan and ROD to address this issue. A minimum depth of excavation within the Proposed Plan is six inches, not one foot as suggested in Alternative 4 of the FS. Excavation would proceed only in those cases where individual lot sampling indicates that properties or areas are greater than the action levels. For those areas which exceed the action levels, excavation is recommended to a minimum depth of 6 inches and a maximum depth of approximately 1.5 feet throughout the 230/500 ppm arsenic/lead kriged contour area.

3. COMMENT: The 950 acre area delineated for a removal action should be restricted to soil areas with elevated arsenic concentrations above the action level. The 41 acre area delineated in the FS (Figure 2-5) with low arsenic concentrations (less than 230 ppm) and relatively high lead concentrations (greater than 500 ppm) should not be included as part of remedial action activities because it does not show the high correlation of arsenic versus lead that the remainder of the Study Area shows, and the levels of lead are within the range of urban background.

RESPONSE: See response to comment 20 in Section 3b, Remedial Investigation.

d. Risk Assessment and Risk Related Issues

1. COMMENT: Was the difference between inorganic and organic arsenic considered in the Exposure Pathways Study and the TPCHD followup urinary arsenic study?

RESPONSE: Yes. Both the Exposure Pathways Study and the followup TPCHD survey focused the study of urinary arsenic on specific arsenic species related to inorganic exposures.

The evaluations of urinary arsenic results in both studies were based on the sum of three measured species of arsenic in urine: inorganic arsenic (arsenic III and arsenic V); monomethylarsonic acid (MMA); and dimethylarsinic acid (DMA). This analytical protocol was adopted in both studies specifically to avoid the potential problems of dietary contributions from seafood, and to focus on issues related to other routes of exposure.

In addition to the arsenic species noted above, the TPCHD survey also reported total arsenic concentrations. Those total arsenic results, however, were not considered in the evaluation of the survey results. EPA notes that the continued testing of urinary arsenic levels on an as-requested basis by TPCHD has used total arsenic analyses, in contrast to the earlier studies. TPCHD does request, however, that those seeking urinary arsenic measurements refrain from eating seafood prior to collecting the urine sample, and that they make a record of what they have eaten.

2. COMMENT: The statement of a 98 percent probability of blood lead levels exceeding the 10 micrograms of lead per deciliter of blood (μg/dl) level in the Study Area does not reflect real world data.

RESPONSE: Asarco appears to misunderstand the nature of the lead risk assessment that was performed. The 98 percent probability of exceeding a blood lead level of 10 μg/dl applies only to those children who would be exposed to soil and dust at a lead concentration of 2,700 ppm, as discussed below.

The cited statement on page 7-10 of the RI Report refers to an "individual risk" that is greater than a 98 percent probability of exceeding 10 μg/dl. The stated risks of exceeding a criterion blood lead level of 10 μg/dl are to be interpreted as the risks that a randomly selected child in the age interval of 0-6 years would exceed 10 μg/dl if exposed to specific environmental (i.e., soil and dust) lead concentrations (see the discussion on pages 6-13 et seq. of the Baseline Risk Assessment). The lead concentration results from soil sampling were used to vary the concentrations for soil and dust within the model. Thus, if a randomly selected child between 0-6 years of age were exposed to soil and dust at a lead concentration of 2,700 ppm, the model predicts a greater than 98 percent likelihood that such a child would exceed a blood lead level of 10 µg/dl. (Other modeling assumptions, such as for absorption factors, are of course also included in these results). This is not a population risk measure related to the incidence of blood lead values across all children within the Study Area; it is relevant to only those children whose exposures are to 2,700 ppm soil lead. Since soil and dust levels vary greatly across the Study Area, and since no individual child is likely to have equal contact across the entire Study Area (or any major part of it), the risk of exceeding the blood lead criterion value will vary by a child's residence location. The lead modeling results (see Table 6.5 in the Baseline Risk Assessment) strongly indicate, for example, that if most of the soil lead concentrations in the Study Area are below 300 ppm, then most children would have less than a 1 percent likelihood of exceeding a blood lead level of 10 µg/dl. The overall incidence in the Study Area of blood lead levels above 10 µg/dl would, under such circumstances, be expected to be quite low.

There are no recent blood lead monitoring data from children living in the defined Study Area. Such blood lead monitoring data, if collected, could well show average blood lead levels considerably below the criterion level of 10 µg/dl. It would be hard to extrapolate from such population distribution data, however, to the individual risks at less frequent but much higher soil lead concentration areas. Both population and individual risk measures have been used at other Superfund sites (e.g., at the Bunker Hill, Idaho site) in evaluating possible remediation goals for lead. EPA believes it is appropriate to consider individual risks for the Ruston/North Tacoma Study Area.

3. COMMENT: Many of the surface soil samples that were collected were not from exposed surfaces and do not represent conditions assumed for use in the risk assessment performed at the site. Incidental contact is unlikely below areas of vegetation, where many of the surface soil samples were collected.

RESPONSE: The major issues related to this comment may be summarized as follows: (1) the existence of a vegetated cover over much but not all of a yard may not sufficiently reduce soil contact rates or calculated exposures and risks, and (2) an existing clean sod cap could be disturbed by any of a large number of actions over time, with the probability of re-exposure of contaminated soils increasing as cap thickness decreases, leading to potential soil exposures (including tracking indoors and subsequent dust exposures) and risks. EPA is concerned with both current and future exposures to contaminated soils in the Study Area, and therefore is concerned with potential disturbances (i.e., long-term maintenance) of existing sod layers. The available studies of soil contact rates have also shown that the degree of grass cover alone is not the determining factor for soil contact; EPA believes behaviors at unvegetated yard areas can still lead to significant soil contact, even if the percentage of the yard that is not vegetated is small (i.e., behavior is also important). EPA believes that the Baseline Risk Assessment has appropriately considered these issues in estimating potential exposures and risks and in characterizing uncertainties in risk estimates that can be evaluated in defining remediation goals or selecting remedial actions. These issues are discussed in more detail below.

Soil data from two studies - the 1988 Black & Veatch sampling discussed in the FIR and the 1990 Bechtel sampling described in the RI Report - are used in the Baseline Risk Assessment evaluations. Both of these studies, as well as the earlier Exposure Pathways Study, note that sampling activities targeted areas that were unvegetated. Thus, much of the 0-1 inch depth interval (surficial) data set used in the risk assessment represents exposed areas without substantial sod cover or other vegetation or capping materials. Photographic records of the locations sampled are included as part of the EPA site files.

Asarco's comment, however, is understood to be less concerned with the actual conditions at sampled locations than with the point that vegetated (e.g., grassy) areas certainly exist in the Study Area and the claim that such sodded areas would reduce or eliminate soil contact, subsequent soil ingestion, and therefore exposures to arsenic or lead within the soil. Asarco comments here that the Baseline Risk Assessment errs in not considering this issue, and in a related comment elsewhere that the long-term effectiveness and protectiveness of a sod cap (as opposed to a thicker soil cap) have not been appropriately considered by EPA. EPA's views on long-term effectiveness and protectiveness are included in Sections 8.0 and 10.0 of the ROD.

The extent of soil contact and ingestion of contaminated soil is a very important parameter within the soil ingestion exposure and risk evaluation. To EPA's knowledge, the soil contact rate studies conducted to date (see page 4-26 of the Baseline Risk Assessment) do not cumulatively show a meaningful correlation between the degree of bare versus vegetated ground (e.g., at a residence) and the estimated amount of soil contact. In the van Wijnen et al. (1990) study, for example, there was no statistically significant difference in calculated (mean geometric) soil contact rates related to the presence or absence of a garden (presumably associated with the extent of bare ground areas). In that same study, children at campgrounds with "fields mostly covered with grass" showed increased calculated soil contact rates compared to children in other settings (e.g., day-care), suggesting that degree of grass cover alone is not the determining factor for soil contact. Most of the soil contact rate studies did not in fact measure or report the extent of bare ground versus vegetated areas in yards or play areas used by the children being studied. A range of "typical" and variable conditions is therefore likely to be included within these studies, which do not provide specific information from which to judge the effectiveness of sod covers in controlling soil exposures.

The effect of sod covers in reducing potential soil contact may exist mostly at the margin, that is in cases where all available areas for human activities are suitably covered and no actions disturbing the sod layer occur. Soil contact rates are likely to be a complicated function of several factors reflecting not only surface conditions (e.g., proportion of area without vegetative cover), but also human behaviors including the time spent at various locations and the types of activities pursued (including some that may disturb an existing sod cap). If some unvegetated areas exist and an individual spends time and engages in activities at those locations sufficient to result in hand-loadings of soil particles, the result may be more or less the same with respect to amount of soil ingested; the extent of unvegetated area may not be critical, and soil contact rates may not bear any obvious relationship to the proportion of total area that is unvegetated. The available research studies show both individual variation in contact rates (even in the same settings) and an inconsistent pattern of relationship between calculated soil contact rates and other variables (e.g., time spent outdoors). Both of these results probably reflect the complexity and variability in factors affecting individual soil contact rates.

For the Baseline Risk Assessment consideration of potential exposures via soil ingestion, the estimated soil contact rates are not based on an assumption of totally unvegetated yards, nor is it assumed that they should be proportionally adjusted for the percent of yard area that is unvegetated. As the preceding discussion should make clear, the soil contact rate is based on the results of studies in which the degree of sod cover is likely to have varied within "typical" ranges, as well as the observation that most properties in the Study Area have some degree of bare ground. Moreover, EPA's Baseline Risk Assessment addresses current and potential future exposures over a relatively long time frame (up to 30 years or longer), and therefore changes in the status of an existing sod cover over time are also of interest.

In both the Baseline Risk Assessment and the evaluation of remedial action alternatives, EPA has considered the potential for contact with contaminated soils in relation to surface conditions and the nature and thickness of any uncontaminated capping materials (e.g., sod layers or clean soil caps). EPA believes that a large number of intentional or unintentional actions could result in disturbance to surface materials in a yard, and that the likelihood of encountering contaminated soils below clean cap materials increases as the thickness of the clean cap decreases. The protectiveness and long-term effectiveness of either an existing sod cap or a newly constructed clean cap are thus related to its thickness. Some disturbing activities could be driven by external factors (e.g., changes related to the sale or purchase of a property, or the loss of vegetative cover from imposition of lawn watering restrictions); others may be driven by the desires of a property owner (e.g., establishing or relocating an unsodded gardening area; establishing or moving a children's play area; or regrading a yard); still others could result from normal play activities, digging pets, erosion, or other causes. The likelihood of disturbance and re-exposure of contaminated materials as a function of clean cap thickness is extremely difficult to quantify and is evaluated based on professional judgment. From the perspective of possible exposures and risks from soil ingestion, existing unvegetated areas or disturbance of a clean cap that re-exposes contaminated soils could both result in contact with contaminated soil; soil analysis results from directly beneath a thin existing sod layer (or a future installed sod layer) could therefore be representative of potential soil exposures. Assuming that an existing sod layer would preclude any future contact with contaminated soil could significantly underestimate actual exposures and risks (i.e., it would assume no probability of disturbance or perfect maintenance over long periods of time). As discussed above, the estimated soil contact rate is not assumed to be adjusted for the proportion of a yard that is unvegetated or disturbed; therefore, the consequences of disturbance of a clean cap are not necessarily proportional to the degree of disturbance.

4. COMMENT: Cleanup levels for the site should have been developed by selectively addressing areas of greatest contamination and then recalculating the RME concentration (upper 95th percent confidence interval) after remediation of these areas. Establishing a cleanup goal of 230 ppm throughout the site actually results in an overall lower RME concentration for the entire Study Area.

RESPONSE: Asarco's comment relates to the issue of the appropriate size of an "exposure unit" over which to calculate an exposure concentration for estimating contaminant intakes and risks. Asarco and its consultants (ETI and Kennedy/Jenks Consultants) have proposed that exposure units should be defined as large subunits of the Study Area or the entire Study Area. EPA disagrees with these proposed exposure units, which inappropriately assume that an individual would have frequent contact with soils and dusts over such large areas. Furthermore, EPA believes the comment does not recognize the important distinction between median, or typical, and RME exposures with respect to how EPA determines risks and appropriate remedial action objectives under Superfund. EPA feels that most of the exposed population, and not just those individuals with typical exposure levels, should be protected. EPA's assumption that an exposure unit should be defined as an individual residential property is consistent with EPA risk assessment guidance and is furthermore appropriate given the large contribution of contact from ages 0 to 6 years to lifetime average daily intakes.

5. COMMENT: Short-term risks associated with implementation of excavation activities (i.e., Alternatives 3, 4, 5, and 6) could be significant, and should be quantified and compared to the benefits of excavation alternatives. Dust generation, short-term exposure to nearby populations, normal hazards associated with construction activities, and risks associated with the transport of contaminated soils nearly 300 miles to an appropriate disposal facility likely outweigh the risk posed by site contamination.

RESPONSE: EPA previously responded to Asarco comments on the characterization and evaluation of short-term risks from remedial actions (see Attachment 2). EPA believes that the short-term risks to the community and to remediation workers are reasonably well known and that measures to successfully mitigate those risks are known and available. EPA further believes that the qualitative evaluations of short-term risks performed in the FS are appropriate, consistent with EPA guidance, and sufficient to support the selection of a preferred remedial action alternative. Monitoring at other Superfund sites where soil excavation and removal actions were performed has demonstrated that exposures of both community residents and remediation workers can be controlled using a variety of site operations practices and personal protection measures. The Ruston/North Tacoma Study Area does not present unique problems in this respect.

For a discussion of the comment on transportation risk issues, see the response to comment number 13 below. The issue of air quality during remedial actions and the applicability of air quality criteria is discussed in the response to comment 19 in section 3(a) above.

6. COMMENT: Residual risks associated with the implementation of each alternative should be quantified as required in the EPA guidance on conducting feasibility studies (Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, EPA 1988). While Alternatives 2 and

3 are assumed to be less protective than Alternatives 4, 5, and 6, the level of protection may be sufficient to address the site. For example, while a 1-foot cap could be more protective than simply sodding or hydroseeding bare areas, the potential human exposure time should be greatly reduced by maintaining vegetational cover in yards as opposed to disturbing it by excavation.

RESPONSE: EPA has previously responded to comments that the long-term risks (effectiveness) of remedial alternatives should be quantified (see Attachment 2). EPA believes that the qualitative evaluations of remedial alternatives provided in the FS and further discussions in the Proposed Plan and Record of Decision provide sufficient information to support the selection of the remedy at this site.

The issue of the protectiveness of sodding rather than soil excavation is discussed elsewhere in these responses (see, for example, response to comment 3 in this section and comment 11 in section 3(a) above). EPA reiterates its view that the long-term protectiveness of a cap on contaminated soils should be evaluated considering the potential for disturbance of that cap and subsequent contact with contaminated soils. In their comment letter, Kennedy/Jenks Consultants stated that sodding and community protection measures as provided in Alternative 3 can be implemented to provide long-term protection. They noted that landfills throughout the U.S. are routinely capped in this way. EPA notes that landfill cover designs commonly incorporate some thickness of cap and not just sodding. The cap thickness is provided to protect against cap disturbance and exposure of refuse materials. More to the point is the fact that in the Ruston/North Tacoma Study Area residents cannot be excluded from their yards, as access to an engineered landfill cap can be controlled. The residential nature of the community is an important factor in EPA's considerations of the performance of capping alternatives. EPA notes that many homeowner actions are commonly taken without formal review (e.g., permitting) procedures, and EPA believes that it could be difficult to assure the maintenance of sod covers. As noted elsewhere by EPA (see comment 3 in this section and comment 11 in section 3(a) above), external events (e.g., lawn watering restrictions) can also affect the maintenance of vegetative covers.

7. COMMENT: EPA's assumptions significantly overstate both the theoretical and actual risks to the community. The controversy over the amount of risk in the Ruston/North Tacoma area illustrates that science cannot prove a negative (absence of risk) since there is always a probability, however small, that the reverse hypothetical may be true. The record compiled by EPA does not show that the site currently presents an unacceptable risk to human health or the environment.

RESPONSE: EPA does not believe that epidemiological findings need to determine the absence of risk, as Asarco states in its comments, to affect risk estimates. EPA agrees with Asarco that they cannot do so. Negative epidemiological results always indicate that (ignoring study methodology issues) risks are not greater than some defined limit, based on the power of the study to detect adverse effects. EPA emphasizes that negative epidemiological results are therefore useful in comparison to risk estimates only to the extent that they show a lower upper limit to those risks.

EPA believes that the Baseline Risk Assessment, completed in accordance with current EPA human health risk assessment guidelines, does show an unacceptable risk to human health and the environment. EPA recognizes that there are uncertainties in risk estimates for the Ruston/North Tacoma Study Area, as there are in all human health risk assessments. Those uncertainties have been identified and considered by EPA in reaching its decisions on this site (see EPA's Preliminary Remedial Objectives Decision Memorandum, January 1992). EPA does not conclude that the risk estimates from the Baseline Risk Assessment provide certainty on the magnitude of human health threats to current or future Study Area residents. EPA does, however, conclude that considering both the risk estimates and the uncertainties attached to them, there is an unacceptable risk under current site conditions.

Asarco has stated on many occasions its view that the negative findings of epidemiological studies of area residents show EPA's risk estimates to be overstated, and that there is no significant risk to human health under current conditions in the Study Area. EPA has responded to such comments already (see Attachment 2). EPA reiterates here that significance in the context of Superfund is not defined in terms of detectability in epidemiological studies, but rather in terms of acceptable risk levels as described in the NCP. The consistency or inconsistency between what epidemiological studies can detect (i.e., their power) and numerical risk estimates should be the focus in reviewing negative epidemiological results. EPA has included such evaluations in its review of this site (see the Baseline Risk Assessment, January 1992). These issues are also addressed elsewhere in these responses to comments (see, for example, the response to comment number 26 in this section).

8. COMMENT: New data indicate that the risks from arsenic to the community are in reality minimal and further underscore the unacceptably conservative assumptions made in EPA's risk assessment. The urinary arsenic data collected by the TPCHD in 1992 indicate that the 1987 urinary arsenic data relied upon by EPA do not accurately reflect current or future exposures. The 1992 urinary arsenic monitoring data should be used in place of the 1987 urinary arsenic data to characterize current or future exposures.

RESPONSE: The design of the recent TPCHD monitoring program, which is based on voluntary, as-requested testing, does not provide data useful for characterizing the current status of the population of most concern: young children living near the former smelter site. Recent monitoring results are also far too limited to support an evaluation of time trends or current distributions in urinary arsenic levels in that population. (Also see the response to comment 21 in this section, below).

Contrary to Asarco's comment, EPA has not relied upon the 1987 urinary arsenic survey results as the basis for determining that remedial actions are needed in the Ruston/North Tacoma Study Area, nor is urinary arsenic monitoring proposed as the measure of effectiveness of remedial actions. (see the Ruston/North Tacoma Site Remedial Action Objectives Decision Memorandum, EPA, January 1992). EPA's determination that remedial actions are warranted in the Ruston/North Tacoma area is based on the results of the Baseline Risk Assessment, including consideration of uncertainties in risk estimates.

Available urinary arsenic monitoring data are reviewed as additional information within the risk assessment, primarily from the perspective of comparing estimated exposure levels with biomonitoring data. EPA believes that urinary arsenic measurements, while the best available biomonitoring approach, have significant limitations that make it appropriate not to base site decisions on them. For example, single urinary arsenic measurements are only representative of exposures over the preceding few days. The variability in urinary arsenic levels over time, and among different individuals, are important considerations. Early urinary arsenic studies of Ruston children noted a synchronicity in rising and falling concentrations within the sampled population over time; such synchronicity could mean that a cross-sectional (point-in-time) sampling approach could in fact be biased low or high, contrary to the commentor's claim. The relationship between urinary arsenic levels and toxicity, especially considering individual differences in arsenic metabolism, is also not well established.

Asarco may mean to include the ongoing Washington State DOH epidemiological study in the "new data" cited in this comment; see the response to comment number 10 below with respect to that study.

9. COMMENT: The 1992 urinary arsenic data are consistent with the lack of adverse effects shown in other American communities exposed to arsenic. The Alaska Department of Environmental Conservation (ADEC) recently evaluated its water quality criteria for arsenic and recommended that the state not adopt what it found to be overly conservative federal criteria.

RESPONSE: The limited usefulness of the 1992 urinary arsenic data for characterizing the current status of the population of most concern (young children living near the former smelter) is discussed in the response to comment 21 in this section, below. EPA notes that there are no health effects studies of that population in progress or planned.

Studies of several U.S. communities where drinking water sources had elevated arsenic concentrations, including Fairbanks, Alaska, have been performed and have reported largely negative findings for adverse health effects. Reviewers have noted that the populations studied have been relatively small and the statistical power of these cross-sectional studies has been limited (see, for example, Hopenhayn-Rich et al. 1993). Moreover, these studies have not addressed adverse effects such as internal organ cancers that are linked to inorganic arsenic exposures.

In evaluating possible arsenic criteria, the State of Alaska has noted state-specific factors in support of its recommendations. While EPA recognizes that the ADEC may reach its own conclusions based on a review of the literature on arsenic and in consideration of conditions in that state, EPA does not feel bound to accept those conclusions in making its determinations for the Ruston/North Tacoma Study Area. The issues raised in the ADEC paper have been raised and reviewed in many other contexts, and have been considered in EPA's evaluations for this site. EPA further notes that the ADEC evaluations as documented in Exhibit C to Asarco's comment letter on the Proposed Plan (Asarco, October 19, 1992) do not reflect recently published results such as those on the methylation data from human studies.

The regulations proposed by ADEC are not yet final. Although some parts of the proposed regulations are scheduled to be reproposed in May 1993, the water quality standards for human health have been temporarily put on hold by the state and may be proposed at a later date. For now, ADEC's water quality standards for human health are those promulgated under EPA's new Toxics Rule (57 Federal Register 60848, December 22, 1992).

It should be noted that following ADEC's 1992 proposal for water quality standards for arsenic and other contaminants, EPA, the state legislature, and members of the public voiced concerns about the proposal. For arsenic, these concerns focused on the lack of scientific accuracy in the development of the proposed standard and on its lack of protectiveness. Based on these comments, the office of the governor in Alaska asked ADEC to reexamine the rules to ensure that they are based on sound and up-to-date scientific studies.

There are questions about the accuracy of several of the scientific statements made by ADEC in developing the arsenic water quality standard, including statements that question EPA's water quality criteria and the Taiwanese study because no increase in cancer incidence was found in studies in Fairbanks, Alaska and Lane County, Oregon. As discussed by EPA in its comments to ADEC, the Taiwanese data and EPA's cancer potency factor are supported by studies in other countries (Mexico and Germany) whose populations are not expected to have diets deficient in protein or to be genetically different than those in the U.S. Also, as discussed by EPA's Scientific Advisory Board, U.S. population studies such as those in Fairbanks and Lane County did not have sufficient statistical power to detect the possible association between arsenic exposure and cancer. The Fairbanks study did not address "long-term carcinogenic effects" but only certain clinical symptoms. Based on the Taiwanese data, the exposure levels (i.e., the arsenic concentrations in Fairbanks drinking water) and the exposure periods (less than 20 years in most cases) were too low to expect an observable increase in cancer occurrence.

10. COMMENT: The Washington State DOH has recently completed a study of the causes of mortality of male residents of Ruston. That study apparently concludes that there is no statistically significant increase in lung cancer deaths due to exposure to arsenic in the community. Asarco recommended that EPA consider that study before final remedy adoption.

RESPONSE: Based on a recent contact with the Washington State DOH, EPA understands that a preliminary draft of the most recent DOH epidemiological study of persons who lived near the former smelter site has been prepared and is beginning a process of peer review. EPA has not received the draft report and was informed that a version would not be released until completion of peer reviews. No schedule for release could be identified by DOH. Since the report is currently unavailable, EPA cannot evaluate it.

EPA is willing to review all available information in making a final decision on remedial actions for the Ruston/North Tacoma Study Area. EPA's decision on remedial actions will not, however, be deferred pending availability of the results of the latest epidemiological study. A series of previous epidemiological studies was reviewed in the Baseline Risk Assessment. A key issue that was identified based on that review was the statistical power of epidemiological studies to detect the levels of risk estimated in the risk assessment process. The issue of statistical power is noted by EPA as still being important for any consideration of additional study results. Other methodological issues that are characteristic of retrospective epidemiological studies, such as the estimation of historical exposure levels (absent any supporting measurements) and the loss of subjects (e.g., due to people moving), would also have to be considered. Finally, it is not clear that the latest epidemiological study includes all of the adverse health effects evaluated in the Baseline Risk Assessment. EPA does not prejudge the study results. However, EPA does note that given the considerations mentioned above, it is EPA's expectation that this single epidemiological study will not provide critical information sufficient to alter EPA's decision on remedial action.

11. COMMENT: EPA has not demonstrated that there are unacceptable risks to the community from lead, or that lead in soil is the cause of any risk that may exist in the community. The results of a recent EPA study (Three City Urban Soil-Lead Demonstration Project, Midterm Project Update, EPA and others, May 1991) did <u>not</u> support the existence of a correlation between soil lead and blood lead. EPA has not performed the first step of conducting blood lead studies in the Ruston/North Tacoma area to determine whether there are elevated levels in residents. Instead EPA again relies upon theoretical risks calculated in a risk assessment. EPA postulates that lead in the community is there because of the smelter, and ignores the many other potential sources of lead in any urban environment. EPA has presented no evidence that would allow it to conclude that there is a "reasonable certainty" that "lead-only" properties should be the subject of a CERCLA remediation.

Exposure to lead is present in urban environments in Western Washington significantly removed from the Asarco smelter. (Also see comment 27 in this section, below).

RESPONSE: EPA believes there is sufficient information to conclude that the smelter was a significant source of soil lead in the Study Area. EPA acknowledges that other sources of lead exist and that elevated soil lead concentrations at specific properties could result from those other sources. Studies at this site (see, for example, the FIR and RI Report) have reviewed the available information and considered the relative contributions of the various possible sources for soil lead in the Study Area. Given the conclusion that the smelter was a significant source for lead, which EPA believes is well supported, EPA's approach in the Proposed Plan and the ROD is to remediate those properties where lead exceeds levels determined to present a potential health threat, as long as there is a reasonable certainty that the elevated lead levels are the result of smelter emissions, and not other possible lead sources.

To determine the soil lead concentrations that could present a potential threat to human health, EPA used the Integrated Uptake/Biokinetic Model for Lead, as described in the Baseline Risk Assessment. That model is used to evaluate potential lead intakes and resulting blood lead levels in the population of most concern: young children. Use of this lead model to evaluate lead threats and cleanup levels at Superfund sites is consistent with current EPA policy and technical risk assessment guidance. Where blood lead data exist, they can be considered in conjunction with lead modeling results. As a matter of policy, however, EPA does not require blood lead monitoring data to evaluate potential health threats.

Asarco comments that there is information from recent studies showing exposure to lead in urban environments in Western Washington significantly removed from the Asarco smelter. EPA does not claim that the smelter is the only regional source for lead, or that the Study Area population is the only exposed population. On the contrary, EPA recognizes that all populations have lead exposure to some degree from common (background) sources including air, soil, food, and drinking water. EPA has evaluated the lead model results for typical (background) urban lead exposures and intakes (see the response to comment 27 in this section, below) to assess model performance in comparison to recently reported Western Washington blood lead data in children for locations other than the Study Area. There is no indication in these data that the model's predictions are inappropriate or overstated. EPA does not believe that the data from other locations reduce the likelihood that smelter emissions have affected soil lead concentrations within the Study Area.

Asarco comments that recent studies have shown remediation of lead-contaminated soils to be ineffective in significantly reducing children's blood lead levels. A recently published journal article by Weitzman et al. (Journal of the American Medical Association 269, 1647-1654, 1993; "Lead-Contaminated Soil Abatement and Urban Children's Blood Lead Levels") discusses the results of the study in Boston, Massachusetts. EPA is aware of these results and believes they should be carefully considered in assessing alternatives for the Study Area. However, EPA also believes that studies of this type are just beginning to be available, and that it is premature to draw definitive conclusions from them. EPA therefore has considered both the study results to date and uncertainty issues related to them, particularly with respect to their applicability to this site (i.e., generalizability issues). EPA notes that Weitzman et al. also discuss several limitations in interpreting study results or applying them generally to lead-exposed populations. There was a modest reduction in blood lead levels in the study populations for whom remedial actions were performed in the Boston study. There is known to be significant individual variability in blood lead levels, even when environmental exposures (e.g., soil levels) are similar. Weitzman et al. report that when many variables possibly related to exposures were controlled, the magnitude of blood lead declines was not substantially changed. However, the effect of soil remediation was enhanced among children who played in their yards more than 15 hours per week. It is possible, therefore, that the effectiveness of soil remediation may be greater than indicated by the assessment of group mean values for some subpopulations who are more sensitive by virtue of their behavior (or individual genetic makeup).

There are additional uncertainty factors that EPA believes need to be considered when evaluating these initial study results for soil remediation effectiveness. The children included in the study may have been older than the most sensitive age group, as noted by Weitzman et al. The study results may have limitations in applicability to sites where the source and chemical characteristics of the lead in soil are different than the urban areas studied. For example, smelter-derived lead may have different bioavailability than urban soil lead. The amount of lead remaining in adjacent, unremediated areas was not controlled in the Boston study, which may have affected recontamination potential and overall individual exposure levels. EPA notes that under the proposed remediation approach in the Ruston/North Tacoma Study Area, all properties at which smelter-derived soil lead exceeds 500 ppm would be targeted for remediation, thus limiting the remaining soil lead levels in the community. Weitzman et al. also note that there are questions about the rate of change in blood lead levels (post-remediation levels reflecting both current and pre-remediation exposures to some degree) and the potentially greater benefits of soil remediation for primary prevention of lead exposures.

EPA recognizes that continuing studies will provide more information about lead risks. EPA has, however, made the determination that action at the Ruston/North Tacoma Study Area should not be delayed pending completion of additional studies, whose timing and results cannot be forecast. EPA further believes that the numerous issues involved in interpreting such study results will not be clearly resolved in the near-term. Therefore, EPA has included in the ROD the cleanup of properties whose soil lead levels exceed 500 ppm where there is a reasonable certainty that elevated soil lead levels do not result from sources other than the smelter.

12. COMMENT: The Proposed Plan characterizes slag as a threat to human health requiring remediation in the absence of contaminated soils. No data exist to support such a claim. In fact, the studies on copper smelter slag and Asarco smelter slag in particular indicate that exposure to metals in the slag in the community are greatly reduced by the physical properties of the material. Arsenic in slag has a low leaching potential and the predominantly large particle sizes of slag reduce arsenic's bioavailability. Consequently, risks by inhalation exposure do not pose an unacceptable risk meriting remediation.

RESPONSE: EPA's risk assessment for slag focuses on the ingestion exposure pathway, not the inhalation pathway. EPA believes that under typical residential (as opposed to occupational, e.g. sand-blasting, applications) conditions, potential slag exposures are primarily via ingestion rather than inhalation. The potential for leaching of slag constituents is also not directly of concern for the ingestion pathway, which focuses on direct slag contact. Drinking water exposures were not evaluated, and the potential mobility of contaminants in slag to adjacent soils was not addressed in the risk assessment. EPA believes tracking of slag particles may be more important than leaching and surface water transport for the movement of slag particles and contaminants contained in slag (see the Tacoma Slag Study, Keystone/NEA, May 1991). Such tracking could, for example, increase contaminant concentrations to some degree in soils adjacent to slag or in house dusts at residential properties where slag is present. The Baseline Risk Assessment discusses the fact that house dusts at homes with slag driveways have been shown to be elevated in contaminant concentrations to some extent.

The fact that slag produced at the former Asarco smelter contains high concentrations of arsenic, lead, and other contaminants is not in dispute, nor is the fact that smelter slag occurs at a number of properties within and beyond the Study Area (e.g., in driveways). Given the presence of slag in the community, the potential for residents to contact that slag through normal behaviors is apparent. EPA believes that given these facts it is appropriate to consider the potential human health risks from such slag contact as part of the overall evaluation of the Ruston/North Tacoma Study Area. EPA notes that there have been repeated questions from community residents about potential slag risks. Within EPA's risk assessment approach (as discussed in the Risk Assessment Guidance for Superfund), the major issues to be defined in evaluating potential slag risks are the degree of slag contact and the bioavailability of arsenic (or other constituents) ingested in slag. Asarco has claimed that the degree of contact is minimal and that arsenic bioavailability is low. EPA does not find adequate support for these claims. EPA disagrees with Asarco's evaluation of potential slag contact and believes that there is little available information on the bioavailability question, which is identified as a major uncertainty for slag risk assessment. EPA has described its approach in estimating these parameters of the exposure equation (see the Baseline Risk Assessment).

Regarding the bioavailability of arsenic in ingested slag, EPA reiterates its view that data to support selection of a specific bioavailability factor for ingested slag arsenic are extremely limited, although several occupational studies show that in settings involving high ambient dust levels of fine particulate, slag absorption does occur. The assumption used in the risk assessment of 40 percent bioavailability, and upon which the determination to cleanup slag has been made, reflects a judgment that arsenic bioavailability will be lower in slag than in soils.

EPA has recently conducted a bioavailability study of Study Area soils and Tacoma smelter slag. Because this study has not been finalized, EPA's risk assessment does not incorporate, and EPA's decision to cleanup soul and slag is not based on, the results from the study. In this study, young swine were fed Tacoma smelter slag or soil from the Study Area, and their blood, urine, and feces were analyzed for arsenic and lead to estimate the bioavailability of these contaminants from ingested slag and soil from this site. Slag and soil particles identical to those fed to the swine were also analyzed using microprobe techniques to determine the texture and composition of arsenic and lead-bearing minerals and other phases that make up the slag and soil materials. Although the data for lead analyses are incomplete at this time, the analytical results for arsenic are available and have been distributed to Asarco and others. A preliminary review of the study data by EPA Region 10 suggests that the value of 40 percent used in EPA's Baseline Risk Assessment for relative bioavailability of arsenic from ingested slag was not overly conservative. The final results for the study will be available once the lead analyses are received, the quality assurance procedures are complete, and the final report has undergone peer review.

Slag risk assessment assumptions are also discussed elsewhere in these responses (see the response to comment 25 in this section, below).

13. COMMENT: Transportation risks associated with transporting removed soil outweigh the risks to the community from metals in the soils.

RESPONSE: EPA continues to believe, as previously noted to Asarco, that the FS evaluations of the short-term effectiveness of remedial action alternatives, including transportation risk elements, have been appropriately performed and considered in selecting a preferred remedial action. (See also the previous responses to Asarco comments in Attachment 2).

Asarco presents transportation risk estimates as though they were relatively certain. In EPA's view, they are both uncertain and probabilistic and in that regard no different than other types of risk estimates, including those related to potential contaminant exposures. The calculation of transportation risk estimates is based on specifying values for various parameters. While some parameters are well characterized (e.g., round trip highway mileage between known origin and destination locations), others (e.g., the accident or fatality rate per distance traveled) are based on summary statistics that may not be representative of the case being evaluated. Annual transportation statistics, for example, include trucks in all states of repair and maintenance, drivers with varying degrees of training or prior accident records, trips at all times of day and under all types of weather conditions, various road designs and conditions, and so on. The operations of hazardous substance transporters may differ from those of the general road traffic in ways important for risk estimates, on one or several of these types of factors. The result is that general accident statistics may be unrepresentative of true accident rates for transporters of hazardous substances or materials from Superfund sites. Asarco does not recognize or discuss such uncertainty issues.

EPA's Risk Assessment Guidance for Superfund, Part C ("Risk Evaluation of Remedial Alternatives") notes that transportation risk issues can be addressed as part of the site health and safety plan developed for remedial actions. Specific actions incorporated in such planning efforts can mitigate and reduce transportation risks.

Transportation risk estimates are also probabilistic, as demonstrated by the fact that specific remedial actions involving transport of materials off site have been completed with no accidents, injuries, or fatalities. The numerical risk estimates should not be confused with the actual outcome of transporting the materials. Thus, the stated transportation risks are both uncertain in magnitude as expected values and probabilistic in nature.

The characteristics of transportation risks are even more important to consider when evaluating remedial action alternatives. As previously noted to Asarco by EPA, the comparison of transportation risks and chemical exposure risks needs to take account of the fact that the former are one-time, short duration risks while the latter will be ongoing to future community residents. Any calculations of incidence must therefore consider an exposed population in the Study Area that represents not one but many successive sets of residents, a fact that Asarco ignores. Moreover, the non-numerical characteristics of these risks (e.g., whether they are voluntary or involuntary, or are associated with other benefits or not), which are not discussed by Asarco, need to be considered as well. Transportation risks and chemical exposure risks are different in kind, not just in magnitude, and their comparison needs to take account of such differences. EPA has included such evaluations in its selection of a preferred remedial action for the Ruston/North Tacoma Study Area.

14. COMMENT: Epidemiological studies should be done for skin cancer and keratoses. EPA should do power analyses of more recent epidemiological studies to determine the consistency of risk estimates with the negative findings of those studies.

RESPONSE: The ongoing epidemiological study being performed by the Washington State DOH (see comment 10 in this section, above) is not available to EPA, and no schedule for release of that report has been given. EPA understands that it is currently undergoing peer review. EPA will not defer its decision on remedial actions for the Ruston/North Tacoma site until that latest epidemiological study is available, but will review it when it is released. Since the cited comment in

Exhibit E to Asarco's comment letter on the Proposed Plan (Asarco, October 19, 1992) is by one of the primary authors of the current epidemiological study, EPA assumes that the report will itself present an analysis of statistical power. As noted previously in the response to comment 10, the issue of statistical power to detect adverse health outcomes is an important factor in EPA's consideration of epidemiological study results.

The earlier Department of Social and Health Services (now DOH) study of lung cancer in women living near the smelter did not provide specific analyses of statistical power (see Archives of Environmental Health, 1987, 42, pages 148-152). The authors state, however, that while the study argues against large excess lung cancer risks, the results may be consistent with a small elevated lung cancer risk (and thus implicitly recognizes the issue of statistical power). In any event, that study does not address the adverse effects from ingested inorganic arsenic that are the primary focus of the current EPA risk management decision.

Medical and epidemiological investigators who have previously considered the possibility of doing a study of arsenic-related skin cancer or noncancer skin effects in the community surrounding the smelter have concluded that such an investigation would be unlikely to be able to detect the levels of impacts that might be occurring over and above background incidence of these effects. EPA does not believe that epidemiological studies of skin effects are likely to provide information that can reduce the uncertainties already recognized in risk estimates for those outcomes that may be related to arsenic exposures in the community.

15. COMMENT: The risk assessment provides little explanation of the default parameters. Are the standard default exposure parameters and conservative (best professional judgment) assumptions for the Ruston community consistent with the national guidance (e.g., "Guidance on Risk Characterization for Risk Managers and Risk Assessors", EPA 1992)?

RESPONSE: EPA has identified numerous default parameters for use in Superfund risk assessments. Those default parameter values were developed to provide for consistency in risk assessment methods at different sites. The issue of consistency in risk estimates was highlighted in the final NCP rule (see preamble discussion) and has been the focus of much public comment to the agency. Absent a well-supported site-specific basis for change, the default parameters are intended to be used at all sites. EPA developed default parameters at the national level based on a review of all available information, and with consideration of EPA policy on RME risk estimates. EPA is aware of no data or compelling arguments for adjusting the default parameters based on site-specific information. Therefore, the default values have been used in the Ruston/North Tacoma Baseline Risk Assessment.

The commentor cites the EPA's February 1992 Guidance on Risk Characterization. EPA notes that the Baseline Risk Assessment for the Ruston/North Tacoma site was issued in January 1992 and was therefore substantially complete before the cited guidance was issued. Nonetheless, EPA believes that the risk assessment for this site is consistent with the objectives of the February 1992 guidance, and in particular that the RME estimates as presented in the January 1992 Baseline Risk Assessment are consistent with the objective of characterizing a conservative but reasonable exposure level in the upper tail of the likely distribution of exposures. EPA notes in this context the comparison of estimated exposures and urinary arsenic data, which generally supports the reasonable nature of the RME estimate in the Baseline Risk Assessment (see the Baseline Risk Assessment and responses to comments 8, 21, 29, and 30 in this section). Finally, EPA points out that the Baseline Risk Assessment included evaluations of potential human health risks at various soil arsenic concentrations (reflecting different points on the distribution of exposures) and provided detailed sensitivity analysis results for alternative exposure modeling parameter estimates. This information provides EPA with risk characterization information of exactly the type discussed in the February 1992 guidance.

16. COMMENT: Some very extreme cases were considered in the risk assessment such as pica ingestion of soil which are not in accordance with EPA guidelines on risk assessment.

RESPONSE: An exposure scenario involving children exhibiting pica behavior was included in the Baseline Risk Assessment. This exposure scenario provided additional information on a potentially sensitive subpopulation, namely those children who have an atypically high frequency of ingestion of non-food items, including soil. As stated in the Baseline Risk Assessment (see page 4-21), the pica exposure scenario was not considered in evaluating RME, and therefore it did not affect the determination of remediation goals for the Ruston/North Tacoma Study Area (see also the Ruston/North Tacoma Site Remedial Action Objectives Decision Memorandum, EPA Region 10, January 1992, Section 5).

EPA further notes that recent literature (see Calabrese and Stanek 1993: "Soil Pica: Not a Rare Event", Journal of Environmental Science and Health 28, 373-384) suggests that pica behavior may be more frequent than commonly thought, at least in some populations. Compared to the data reviewed by Calabrese and Stanek, the soil ingestion amount assumed for the pica case in the Ruston/North Tacoma Baseline Risk Assessment is rather moderate, and certainly cannot be characterized as "very extreme".

17. COMMENT: The ingestion slope factor (1.75 kg/mg-day) for arsenic used by the EPA in the risk assessment is slightly overestimated due to round-off error.

RESPONSE: Consistent with Superfund risk assessment guidance, the oral slope factor used to assess cancer risks from ingested inorganic arsenic was obtained from the Integrated Risk Information System (IRIS) file. The listed slope factor value of 1.75 $(\mathrm{ppm/day})^{-1}$ was adopted for IRIS after detailed reviews by EPA. The arsenic slope factor, in common with many other slope factors listed in IRIS, may include a minor degree of rounding from detailed values as calculated from raw data; such rounding is in EPA's opinion appropriate given the nature of the data (including various uncertainties, missing data, and so on) and methods by which slope factors are calculated (simplifying assumptions on average dose levels, for example). The slope factor estimates are in all cases recognized as uncertain, and that uncertainty is already considered in making risk management decisions (i.e., in determining remediation goals from risk assessment results). EPA believes the small degree of rounding in the IRIS-listed slope factor from numerical values derived in EPA's detailed analysis of the raw data (see the 1988 Special report on Ingested Inorganic Arsenic) is of no practical consequence for risk estimates or risk management decisions at the Ruston/North Tacoma site.

EPA notes that the risk estimates for ingested arsenic are based on a point estimate of the slope factor; and not on any upper confidence limit value for that slope factor (see the Special Report on Ingested Inorganic Arsenic, EPA 1988, page 29).

18. COMMENT: A 76.2 year lifetime is more consistent with the way the arsenic slope factor was developed and thus technically should be used in the risk assessment rather than the default 70 year value.

RESPONSE: EPA agrees with the commentor that the exposure assessment assumptions should be consistent with the methodology used to develop toxicity parameters. In the case of the cancer slope factor for ingested arsenic, a lifetime of 76.2 years was assumed in developing the previous ingestion slope factor (in 1984). The current slope factor as developed in 1988 ("Special Report on Ingested Inorganic Arsenic", EPA, July 1988), however, does not use that same assumption. Therefore, EPA did not use a lifetime of 76.2 years in its risk assessment for the Study Area.

The methodology used to determine the current slope factor (equivalently, the unit risk estimate) for ingested inorganic arsenic is described in the Special Report on Ingested Inorganic Arsenic (1988) and in a later journal article ("A Dose-Response Analysis of Skin Cancer from Inorganic Arsenic in Drinking Water", Risk Analysis, 9, 519-528). The previous risk estimate for ingested inorganic arsenic (Health Assessment Document for Arsenic, EPA 1984) was based on an assumption that a lifetime equals 76.2 years and was calculated in the absence of competing risk. In contrast, the 1988 re-evaluation and revision of the slope factor used a life-table approach, adjusting for the survivorship of the U.S. population by age. The current slope factor is therefore not based on an assumption of a (uniform) 76.2-year lifetime. It includes the range of lifetimes (i.e., survivorship periods) in the risk estimate rather than any one selected lifetime duration. This is atypical for EPA dose-response and risk evaluations, and it is difficult to precisely match the slope factor so derived with any one specific lifetime period for calculating lifetime average daily doses in estimating cancer risks. The variation in risk estimates resulting from assuming a lifetime of 70 versus 76.2 years is quite small in comparison to other recognized sources of uncertainty in risk estimates, which are already considered in risk management evaluations. The use of a 70-year lifetime assumption is consistent with EPA's standard default assumptions for risk assessment.

19. COMMENT: The EPA letter responding to Asarco comments on the Baseline Risk Assessment (see Attachment 2) appears to dismiss methylation and detoxification of arsenic as a factor which potentially reduces risk. The letter states that because detoxification at lower doses is no more than 80 to 90 percent complete, some possibility of risk remains at lower doses even for those who can methylate arsenic. The available evidence on the toxicology of arsenic and methylation ability does not support EPA's contention. The assumption of no reduction in exposure by detoxification is a worst-case scenario because even those who are slow methylators still have some arsenic detoxification which would reduce the amount of exposure at low doses versus high doses.

RESPONSE: There have been numerous reports in the literature of measurements of arsenic species in urine in both arsenic-exposed and background populations. The sum of three measured arsenic species (inorganic arsenic and two methylated species, MMA and DMA) in urine is generally accepted as an indicator for total absorbed inorganic arsenic dose, excluding exposures to complex organic forms of arsenic such as those common in seafood. A review and assessment of those urinary arsenic monitoring results has recently been published (see Hopenhayn-Rich et al. 1993, "Human Studies Do Not Support the Methylation Threshold Hypothesis for the Toxicity of Inorganic Arsenic", Environmental Research 60, 161-177). That review states that regardless of the exposure level, over a wide range from background to relatively high occupational, environmental, or experimental exposures, the average percentage of inorganic arsenic among the three measured species related to inorganic arsenic exposures remains approximately the same. This assessment provides no support for the assumption that at low doses an effective methylation process exists that reduces risks estimated on the basis of high exposure populations. These data suggest a methylation process that is, if anything, linear and proportional rather than saturable over the range of exposures reviewed.

Hopenhayn-Rich et al. also note that the interindividual (and possibly intraindividual) variability in the proportion of excreted arsenic that is inorganic (i.e., unmethylated) is quite large, independent of the exposure level. They note as well that the exact mechanism responsible for methylation of inorganic arsenic in humans has not been identified.

EPA continues to believe that there are significant interindividual differences in the metabolism of inorganic arsenic and that it is reasonable to assume that these interindividual differences place some persons at greater risk than others for a given level of exposure. The literature includes information suggestive of increased susceptibility in some individuals (see "The Absorption of Arsenic and Its Relation to Carcinoma", Bettley and O'Shea, 1975, British Journal of Dermatology 92, 563-568). Based on the Hopenhayn-Rich et al. review of available urinary arsenic monitoring data, there does not appear to be a well-supported rationale for changing risk estimates for ingested inorganic arsenic that are based on toxicity parameters developed from high exposure populations. The possible nonlinearities in dose-response and the possible biological mechanisms that could reduce risks at lower doses are recognized within the uncertainties in arsenic risk estimates.

20. COMMENT: The absorption factor used in the EPA risk assessment is 80 percent based on best professional judgment. This factor seems high in comparison to the evidence reviewed and discussed in the risk assessment which indicates absorption factors in the range from 30 to 50 percent, not including the results of Griffin and Turk (1991).

RESPONSE: The available information from bioavailability studies of soil arsenic was reviewed by EPA in the Baseline Risk Assessment (see pages 4-30 and 4-31, for example). The uncertainty in the relative bioavailability factor within the RME equation was also addressed (see, for example, Chapter 8 and Appendix H); EPA noted that risk estimates for ingested arsenic from soil/dust would vary linearly with changes in the assumed bioavailability factor. EPA believes the following summary statement from the Baseline Risk Assessment (page 4-31) is still accurate and supports the selected factor of 0.80 used in the risk assessment:

"The available information on relative bioavailability of arsenic from soils is limited, subject to difficulty in interpretation because of inter-animal or inter-administration group variation, or of questionable representativeness for soils in the Ruston/North Tacoma Study Area. There is, however, sufficient information to support a reasonable likelihood that the bioavailability of arsenic in soils is reduced from that in drinking water, and that a relative bioavailability factor less than 1.00 should be used in estimating exposures and risks from ingested soil. Based on best professional judgment, and incorporating a bias for not underestimating RME exposures, a relative bioavailability factor of 0.80 is assumed for the risk assessment [for soils and house dusts]."

The factor within the exposure equation is appropriately referenced as the relative bioavailability, and it should not be confused with the absolute bioavailability. This is significant for interpreting the results of bioavailability studies. The toxicity factors for ingested arsenic are based on arsenic in drinking water; the bioavailability of arsenic in drinking water is often assumed to be close to 1.00. However, in bioavailability studies the calculated bioavailability (absorption) for positive control group subjects who are given aqueous (oral gavage or intravenous) arsenic is often different than 1.00, sometimes substantially different. This difference can result from methodological problems in the study, measurement errors, or other factors. The significance of a lower calculated bioavailability for such positive control group subjects is that the **relative bioavailability** for other groups (i.e., their calculated bioavailability divided by the positive control group results) is increased compared to their absolute bioavailability. EPA notes in this regard that the studies of bioavailability of arsenic from soil matrices have shown positive control group bioavailabilities well below 1.00. Therefore, the (calculated) absolute bioavailability results in these studies are substantially below their (calculated) relative bioavailabilities.

EPA also notes that the results from studies available at the time the Baseline Risk Assessment was prepared are of very limited usefulness for determining an appropriate relative bioavailability factor for the Ruston/North Tacoma Study Area. The one site-specific study reviewed ("Bioavailability of Arsenic in a Refractory Matrix", Boyajian 1987) has several significant methodological issues, including positive control group results that are lower than test group results; the studies for other sites of different types of materials (e.g., mine tailings) are of questionable relevance for the soil matrix at Ruston/North Tacoma.

As discussed in the response to an earlier comment (see number 12, above), EPA Region 10 has recently conducted a bioavailability study for Study Area soils and Tacoma smelter slag. Because this study has not been finalized, EPA's risk assessment does not incorporate, and EPA's decision to cleanup soul and slag is not based on, the results from the study. In that study, young swine were fed soils or slag and their urine, blood, and feces were monitored. Microprobe analyses of soil and slag particles were also performed separately from the swine study to determine the texture and composition of arsenic and lead in those materials from the site. While a report of the study has not yet been prepared, the arsenic analytical results from that study of Study Area soils are now available and have been distributed to Asarco and others. A preliminary review of the results by EPA Region 10 suggests that the relative bioavailability value of 80 percent used in EPA's Baseline Risk Assessment, and upon which the selection of action levels and the determination to cleanup soils has been made, is not overly conservative for estimating potential arsenic exposures from soil ingestion in Ruston/North Tacoma. Final study analyses and discussion of the results will not be available until after completion of peer review.

21. COMMENT: The recent urinary arsenic data collected in 1992 by the TPCHD indicate that the 1987 urinary arsenic data may not accurately reflect current or future exposure. EPA should consider the declining trend in urinary arsenic levels over time in its estimates of arsenic exposure and bioavailability for the community.

RESPONSE: (See also the response to comment number 8 in this section, above). The urinary arsenic monitoring recently performed by the TPCHD was conducted on a voluntary, as-requested basis. It differed in significant ways from earlier urinary arsenic studies, including the 1987 urinary arsenic survey conducted by TPCHD of young children living within approximately one-half mile of the former smelter site. It was never intended as a "follow-up" study to the 1987 survey; the recent monitoring program is not a statistically-designed study and offers little information suitable for evaluating trends in urinary arsenic levels.

Of the 44 results reported for samples submitted through July, 1992 in the recent round of TPCHD testing, only 5 represent children under the age of 8 years living within one-half mile of the smelter. Only a single urinary arsenic sample was tested for these 5 children, in contrast to repeated measurements of a much larger group of children in both the Exposure Pathways Study (N=21 children) and the 1987 TPCHD survey (N=88 children). This data set is far too limited to evaluate trends in urinary arsenic levels in young children living near the smelter, or to characterize the current status of that population.

22. COMMENT: The problem with the uncertainty analysis in the appendix to the risk assessment is that variables are largely evaluated in isolation, and their combined impact on the risk and cleanup level is not discussed. For example, the average exposure parameters, not including bioavailability, result in 12 times less exposure than predicted by the RME parameters. This difference would result in a cleanup level of 2,700 ppm instead of 230 ppm.

RESPONSE: EPA believes that the uncertainty analysis in the Baseline Risk Assessment does provide relevant information on the results of changing multiple factors concurrently within the exposure and risk equations. The introductory discussions of uncertainties in Chapter 8 and Appendix H of the risk assessment introduce this idea of the potentially large changes in risk estimates from combined changes in assumptions <u>before</u> proceeding to sensitivity analyses of individual parameters within the calculation of risks. The following statement is included in the introduction of Chapter 8:

"Selected sensitivity analyses were performed to address several specific components of risk calculations. The results of those sensitivity analyses, which provide a simple approach to quantifying uncertainty, are presented and discussed in Appendix H. Those results are useful in supporting the general, qualitative evaluation of risk assessment uncertainties at this site. **Given the large number of parameters included in the equations for quantifying risks, and the fact that uncertainties from multiple factors often combine multiplicatively, the overall effect of varying numerous assumptions simultaneously can be a change in estimated risks of several orders of magnitude.**" [emphasis added]

The discussion of uncertainties in Appendix H identifies the structure of the soil/dust ingestion pathway risk equation (see Section 1.1 in Appendix H) and notes the following:

"Changes in more than one exposure parameter at the same time will combine to produce an overall change in resulting exposure estimates. If all of the parameters individually have linear effects, the total change from combined variations will be multiplicative."

The distinction between uncertainties in exposure estimates and variability within an exposed population is discussed elsewhere in these responses (see response to comment 28 in this section, below). The discussion in Appendix H includes a comparison of calculated exposures for RME and average exposure assumptions (see Table H-1); these variations reflect different points within the assumed distribution of exposures for the Study Area population. The discussion in Appendix H includes the following statement (see page H-4):

"If the comparisons shown in Table H-1 are expanded to include changes in exposure point concentrations and also a reduced relative bioavailability factor, **a total reduction by more than 100-fold (two orders of magnitude) in estimated exposures compared with the RME value could result.**" [emphasis added]

EPA emphasizes that estimates of the potential exposures that were used in setting the action level for arsenic for the site are based on RME estimates. RME estimates are upper bound estimates that EPA expects would be exceeded by only a small fraction (e.g., five percent) of the population that is potentially exposed to the contamination. Thus, RME estimates are by intent more conservative than estimates based on typical, or median, exposure assumptions. EPA believes, therefore, that an action level based on RME exposure assumptions will be protective for most of the exposed population, and not just individuals with average exposure levels.

The commentor suggests that changes in risk estimates will result in proportional (linear) changes in remediation goals for the Study Area. This is a fundamental misunderstanding of the process by which remediation goals are developed by EPA. EPA notes two major errors in the stated assumption. First (as discussed above), EPA bases its decisions on remediation goals on RME estimates and not on estimates of other selected points in the population distribution of exposures and risks. Thus, the fact that average case exposures may be a certain fraction of RME exposures is not relevant to the determination of remediation goals. Second, EPA already considers the uncertainties in RME exposure and risk estimates in its development of remediation goals (see the "Ruston/North Tacoma Site Preliminary Remedial Action Objectives Decision Memorandum", EPA Region 10, January 1992). As a result, possible modifications in exposure factors to address potential uncertainties (including combined uncertainties) that affect calculated risks are in many cases already reflected in the selected remediation goals; to adjust those goals again would in effect amount to double counting. The remediation goal for soil arsenic should not be modified in the manner suggested by the commentor.

23. COMMENT: Recent guidance ("Supplemental Guidance to RAGS: Calculating the Concentration Term", EPA, May 1992) on calculating the exposure concentration term specifies that exposure concentrations should be calculated based on the average concentration that might be contacted over the period of exposure (i.e., 30 years) using an 95 percent upper confidence limit (UCL) of the average soil data based on lognormal statistics if the data are lognormal. The guidance states the highest measured or modeled value may be used as a concentration term in the event that the 95 percent UCL exceeds the maximum concentration, which is not the case for the Ruston community. The EPA risk assessment used the 95th percentile sample concentration as the exposure concentration for the RME. EPA guidelines, however, do not explicitly recommend such a percentile nor do they state that a single sample concentration should be considered the exposure concentration without consideration for other samples from nearby areas that might provide some indication of spatial variation within a yard. The Asarco risk assessment ("Comparative Evaluation of Health Risks and Cleanup Levels for the Ruston/North Tacoma Study Area", Environmental Toxicology, Inc., November 1991) evaluated exposures within a 1/2 mile of the plant site separately from those in the 1/2 to 1 mile zone. This separation of areas reduced the dilution of concentrations by areas further from the plant site which have lower soil levels. Like other exposure assumptions, a few people may be exposed at higher levels but most people would receive lower levels.

RESPONSE: The concentration term used in the exposure (intake) equation in the risk assessment needs to be representative of concentrations over the area in which contaminant contact by an individual will take place. Thus, the idea of an exposure unit is implicit in the exposure equation, and the size of the exposure unit must be determined first. EPA has commented previously on Asarco's use of averages (geometric mean concentrations) over very large portions of the Study Area (see Attachment 2). EPA reiterates its position that assuming equally likely contact over areas as large as those used by Asarco in calculating soil exposures is inappropriate. EPA assumes that this comment may be guided by the way in which the soil concentration term is used within the uptake biokinetic model for lead, where it represents an average over a sizable area. It should be noted that the uptake biokinetic model also applies an estimated population distribution term (the Geometric Standard Deviation) to the results of calculations based on average soil concentrations before producing risk estimates. There is no comparable step in the Asarco risk assessment, which therefore reflects typical (median) exposures rather than RMEs. Moreover, the technical support document for the uptake biokinetic model notes that it may not be appropriate to apply the model using an average soil concentration value if the soil lead concentrations are quite heterogeneous over the defined area. EPA does not believe the concentration term as used in the uptake biokinetic model is a relevant approach for the assessment of arsenic risks at this site.

EPA believes that the individual residential property is an appropriately sized exposure unit for risk assessment purposes and is consistent with stated EPA risk assessment guidance. (See EPA's previous responses to Asarco in Attachment 2). EPA further notes that property owner actions that can substantially affect soil contaminant concentrations are taken within property boundaries. One result is that adjacent properties may have quite variable soil contamination levels, as seen in the FIR/RI soils data set. Therefore, soil concentrations on one property may have little relevance or statistical association with those on nearby properties, and it is not possible to accurately estimate soil contaminant concentrations across property boundaries.

Given that the individual property is an appropriate exposure unit for risk assessment, and the fact that the FIR/RI data set includes only one (composite) surficial soil sample per property, the Baseline Risk Assessment used that value to estimate individual exposures and risks. Thus, estimated individual exposures and risks varied as a function of the soil arsenic concentration on a property. EPA believes that the use of an estimated 95th percentile soil arsenic concentration, from the distribution of (mean) values across residential properties, for the RME is consistent with the definition of an RME as an exposure that is expected to be exceeded by a small percentage of exposed individuals (i.e., it is an upper tail value from the distribution of exposures).

24. COMMENT: The soil ingestion rate for the Asarco "revised RME" scenario (85 mg/day) is not a median as stated by the EPA comment letter (August 13, 1992), but the highest upper 95 percent confidence interval of the median for reliable tracers (Calabrese and Stanek, 1991). The comment letter states that EPA feels that 200 mg/day is more appropriate but little rationale is provided. The assumption of 100 percent for the soil ingestion rate for warmer seasons half the year and 50 percent for cooler seasons for half the year is based on soil ingestion studies of children which show that soil ingestion is decreased by half during periods of wetter weather. EPA assumes that the amount of soil that a child eats is constant and uninfluenced by the amount of time outdoors.

RESPONSE: EPA's standard default assumptions for soil ingestion rates represent long-term average daily contact rates. EPA believes there may be much day-to-day variability in actual contact rates for an individual (although there are almost no longitudinal study data on the same individuals); weather conditions may be one among many variables that can affect daily soil contact rates. EPA does not, however, find that weather conditions in the Study Area are so extreme as to warrant an adjustment in the standard default assumptions, which are to be viewed as long-term average values.

25. COMMENT: Any risk assessment of slag requires many assumptions and procedures that may not follow EPA guidelines which were developed for soil and other more standard exposure scenarios. Such risk assessments are therefore more of a screening tool. The EPA risk assessment of slag contains many assumptions that are not scientifically sound and do not follow EPA guidelines. For example, there is little basis to support that resident's exposure to slag outdoors, including adults, would be proportional to the percentage of slag outdoors. EPA made no allowance for the demonstrated fact of the armoring effect of larger slag particles. EPA's assumptions that children and adults regularly eat and absorb arsenic in large particles of slag as readily as in small particles

likewise has no scientific basis. The factor contributing the most to the difference in risk estimates for slag is that EPA chose to ignore the effect of particle size and armoring on exposure to slag outdoors.

RESPONSE: EPA agrees with Asarco that the risk assessment for slag requires and incorporates additional assumptions beyond those used in the risk assessment of soils. Those assumptions are developed on a site-specific basis rather than being derived from standard default guidance; they are discussed in the Baseline Risk Assessment. As discussed elsewhere in these responses (see response to comment 12), the two primary issues for consideration in the slag risk assessment are the degree of contact with slag and the bioavailability of arsenic (or other constituents) in ingested slag. It is the level of certainty or uncertainty in exposure modeling assumptions for slag, rather than the mere existence of parameters for which there are not standard EPA default values, that determines the degree to which slag risk estimates reflect screening level values (in comparison to risk estimates for other exposures).

Uncertainties in EPA's estimate of arsenic risks from ingested slag are considered in some detail in the Baseline Risk Assessment (see Appendix H). Both slag contact and bioavailability assumptions are included in those uncertainty evaluations. EPA reiterates its view that data to support selection of a specific bioavailability factor for ingested slag arsenic are extremely limited, although several occupational studies show that in settings involving high ambient dust levels of fine particulate, slag absorption does occur. The assumption used in the risk assessment of 40 percent bioavailability, and upon which the determination to cleanup slag has been made, reflects a judgment that arsenic bioavailability will be lower in slag than in soils; exposure and risk estimates are noted to vary linearly with the bioavailability value.

EPA Region 10 has recently conducted a bioavailability study of Study Area soils and Tacoma smelter slag (see the responses to comments 12 and 20 above). While a report of the study has not yet been prepared, a preliminary review by EPA Region 10 of the arsenic analytical results of that study suggests that the relative bioavailability value of 40 percent used in EPA's Baseline Risk Assessment does not appear to be overly conservative. The final analysis and discussion of the results of the study will not be available until after completion of peer reviews. Because this study has not been finalized, EPA's risk assessment does not incorporate, and EPA's decision to cleanup soil slag is not based on, the results from the study.

The evaluation of potential slag contact considered both the area of a residential property that is covered with slag and an allocation of the EPA default value for daily soil/dust contact. EPA notes that the slag and soil risk estimates in the Baseline Risk Assessment are not additive, because only the slag exposure model considered the allocation of contact rate between slag and soils. (Sufficient information is provided in Chapter 4 and Appendix H of the Baseline Risk Assessment to calculate combined slag and soil exposures and risks at any assumed soil arsenic concentration). The area covered by slag is assumed to be 25 percent of the available yard area. As part of the uncertainty (sensitivity) analyses in the Baseline Risk Assessment, the slag area was varied from 5 to 75 percent of the available yard area (see Appendix H).

EPA does not agree with the commentor's statements regarding the potential for slag contact. EPA addressed slag issues in a previous response letter to Asarco (see Attachment 2). The potential degree of contact with slag is determined by several factors: the size of the area covered by slag; the behaviors of individual residents, including young children (i.e., where they spend time and what activities they perform); and the physical characteristics of slag. There will be individual variability in the degree of slag contact, just as there is for soil contact. The commentor states that EPA's assumptions for contact rate parameters are not reasonable. EPA believes that they are reasonable, that the comments provide no supportable basis for alternative assumptions, and that there is no inherent property of slag-covered areas that would exclude or minimize potential contact with and ingestion of slag particles. Slag-covered areas such as driveways (a predominant use of slag in the community) are in fact likely to have frequent use, since they are likely to be used for access to residences and vehicles. They may provide preferred areas for various types of activities, including children playing or adults doing vehicle maintenance; slag-covered areas would not, for example, be expected to be as muddy as other unpaved yard areas for much of the year. EPA has in fact observed children and adults using driveways for such activities within the Study Area. EPA's basic assumption for risk assessments is that there is an equally likely probability of contact in all areas of the property (as discussed, for example, in the Supplemental Guidance to RAGS: Calculating the Concentration Term, May 1992). EPA believes the assumption of proportional contact with slag-covered areas is a "simple but reasonable approach" as described in its risk assessment guidance, and one that is consistent with other EPA risk assessment practices.

With respect to particle size issues, EPA disagrees with the commentor's conclusions related to particle size issues on potential slag contact and ingestion. Moreover, EPA has noted that there is a demonstrated increase in the concentration of arsenic (and other slag constituents) in smaller particle size ranges that has not been reflected in any of the risk assessments for slag. The observed increase in house dust concentrations of arsenic at properties with slag driveways ("Tacoma Slag Study", Keystone/NEA, May 1991) is supporting evidence that the armoring of slag as it occurs in the community is not complete or effective in eliminating slag mobility, particularly of smaller particle sizes. EPA believes that there is no evidence to support armoring as a control on potential exposures to slag. Asarco's slag risk assessment assumes that the default contact rate should be reduced proportional to the percentage of slag particles that are below a defined size criterion. EPA finds no technical basis for such an assumption and believes it to be in error. The standard exposure assessment for soils, for example, does not adjust for the fraction of soil particles that are below a specified criterion size such as the one used in Asarco's slag risk assessment. EPA does not assume that all slag particles are equally likely to be ingested, regardless of size. Smaller slag particles may be more likely to adhere to a child's hands and be ingested, for example. EPA believes that the amount of slag (or soil) adhering to skin or other objects and available for ingestion is unlikely to be linearly related to the finer-fraction percentages of the slag (or soil) matrix. The relationship may be more one of a threshold; if contact with the matrix coats the surface of the hand, for example, doubling the finer-fraction percentage in the matrix would not be expected to significantly increase the hand loading.

26. COMMENT: The reason that the epidemiological studies do not seem to impact risks or cleanup decisions is that according to federal policy regulated risks are far below the level that can be measured or observed in most communities impacted by hazardous waste sites. Another difficulty is that science cannot prove a negative (e.g., absence of risk). The executive summary of the EPA risk assessment presented a misleading interpretation of the epidemiological information. The statement seemed to be referring to the study performed by the Washington State DOH ("Lung Cancer Among Women Residing Close to an Arsenic Emitting Copper Smelter", Frost et al. 1987): "One retrospective lung cancer study did find a somewhat higher estimated arsenic exposure associated with lung cancer than with other cancers, suggesting a possible arsenic relationship for lung cancers." What it fails to mention is that this result was not significant and may have been caused by other confounding factors unrelated to arsenic exposure.

RESPONSE: EPA agrees with the commentor's statement that risk levels of concern at Superfund sites are commonly well below levels that can be detected in even well-designed epidemiological studies. That fact is noted in EPA's Risk Assessment Guidance for Superfund (Part A: Human Health Evaluation Manual; EPA 1989) in its discussion of the usefulness of epidemiological studies for risk assessment purposes. The EPA guidance includes the following statement (see page 8-25):

"The small populations and variable exposures predominating at most Superfund sites will make it extremely difficult to detect site-related effects using epidemiological techniques."

EPA does not in fact generally base its decisions at Superfund sites on epidemiological confirmation of adverse health effects. The decisions on acceptable risk levels are risk management decisions, rather than risk assessment questions. Those risk management decisions have been incorporated into the NCP, which provides the framework within which the Ruston/North Tacoma studies, including the Baseline Risk Assessment, are carried out. The acceptable risks defined in the NCP are in fact quite small as compared to risks that are detectable in health studies. Asarco has frequently commented that the results of epidemiological studies for this community show that there are no adverse health effects, or at least that there are no "significant" effects. (See the previous EPA responses to Asarco comments in Attachment 2). EPA notes that in this context, "significant" is defined by the levels identified in the NCP rather than levels that are identifiable in epidemiological studies. Contrary to the assertion by the commentor, there is no requirement for epidemiological studies to "prove a negative (e.g., absence of risk)". The issue is risks of a given magnitude, not the total absence of risks. For epidemiological studies to be useful to EPA in reaching a decision on the need for remediation at a site, they must simply provide well-supported evidence (considering uncertainties, confounding factors, and other study limitations) that the risks are lower than estimates arrived at by a risk assessment process for the adverse health effects of potential concern. Thus, the consistency of epidemiological and risk assessment results is the primary issue. Epidemiological study results have been reviewed in some detail by EPA for this site (see the Baseline Risk Assessment, Chapter 7).

The statement cited by the commentor from the executive summary of the risk assessment occurs on page ES-5 and is part of the following paragraph:

"One retrospective lung cancer study did find a somewhat higher estimated arsenic exposure associated with lung cancer than with other cancers, suggesting a possible arsenic relationship for lung cancers. The lung cancer study now being performed by the Washington State DOH should provide additional information related to this finding. The inhalation arsenic exposures involved in these retrospective epidemiological studies are far greater than current community exposures and therefore do not directly contribute to current risk estimates."

These results are discussed in more detail within the body of the Baseline Risk Assessment report. The text on page 7-14 includes the following statements:

"Frost et al. (1987) calculated an exposure index for each case and each control subject to represent relative cumulative exposures to airborne arsenic (see Black and Veatch 1988a and Frost et al. 1987 for details). The exposure indices for cases and controls were statistically compared. Those comparisons showed arsenic exposure indices were higher in lung cancer cases than in matched controls, with statistical significance levels as low as $p=0.07$. These results, although not attaining a significance level of $p=0.05$, suggest the possibility of an arsenic-related effect on lung cancers within the study population. Other possible interpretations and potentially confounding factors are discussed by the authors (Frost et al. 1987)."

The risk assessment therefore already provides the information sought by the commentor. EPA notes that this exposure index result was noted by the primary author of the study (Frost) in discussions with those preparing the risk assessment report; the published study ("Lung Cancer Among Women Residing Close to an Arsenic Emitting Copper Smelter", Archives of Environmental Health 42, 148-152, 1987) includes the following discussion of results:

"The findings of this study appear to be mixed. An elevated incidence of lung cancer was not detected in comparing observed with expected lung cancer rates. However, the arsenic exposure indices were higher in cases than in age-matched controls. The difference was not significant at the .05 level. Several factors could explain these mixed results and the inability of the study to detect an effect of arsenic exposure on lung cancer incidence...

Despite these limitations, the study argues against large excess lung cancer risks for communities exposed to ambient arsenic. The results may be consistent with a small elevated lung cancer risk for people who resided close to the smelter for a period of over 20 yr.".

Given these statements in the published study and the risk assessment report text, EPA believes the 1987 epidemiological study results are appropriately discussed. Furthermore, EPA notes that several of the confounding factors mentioned by Frost et al. (1987) do in fact relate specifically and directly to arsenic exposures. For example, the authors note the difficulty in quantifying actual (historic) exposure levels by location and the potential effects of changing residence locations (population mobility) on actual exposures. The inability to control or adequately quantify such effects are in fact primary reasons for limitations in the statistical power of or certainty in results of epidemiological studies, in addition to relatively small numbers of exposed individuals.

27. COMMENT: There is little evidence to support the cleanup of lead in the Study Area, especially for areas in which arsenic levels do not exceed the 230 ppm action level. Such a cleanup is unwarranted for several reasons: (1) lead levels are not particularly elevated compared to background in urban areas and older communities such as the Ruston/North Tacoma area, (2) the correlation of lead levels with proximity to the smelter is uneven, (3) ambient air levels of lead in this area are not elevated over background, (4) lead levels from operation of the plant as a lead smelter at the turn of the century and later as a copper smelter should have declined with time as lead levels in the environment have declined since the recent decrease in leaded gasoline and paint use, (5) the available epidemiological studies indicate that the lead levels in the community would not be expected to be associated with increased blood lead levels in excess of current health guidelines.

In addition, compared to the 1991 estimated mean blood lead level of 4 to 6 µg/dl ("Maximum contaminant level goals and national primary drinking water regulations for lead and copper: Final Rule; 56 Federal Register 26460, EPA 1991), 70 percent of tested children in western Washington had blood lead levels that were undetectable (4 µg/dl or less). Thus, the assumptions of the uptake biokinetic model used by the EPA risk assessment probably overestimated the amount of background lead exposure because these assumptions are based on national data, some of which date back to earlier studies of lead exposure in the U.S. Overestimated background lead exposure would inflate the lead action level determined using this model.

The 10 µg/dl cutoff as a blood lead level of concern should also be recognized as a conservative policy decision. The significance of possible subtle effects of lead at low levels of exposure is not as clear-cut as portrayed by the risk assessment.

RESPONSE: EPA recognizes that there remains some uncertainty over the effects of lead at low levels of exposure. Many summaries of the research on such low-level adverse effects are now available, with discussion of such uncertainties. EPA notes that over time the level of concern for adverse effects from lead has decreased repeatedly and significantly as new information has been developed in additional research studies. EPA has made a risk management determination that an appropriate level of concern and one that should be used as a basis for developing remedial action objectives is a blood lead level of 10 µg/dl in young children; the commentor is correct that this is a risk management and not a risk assessment issue. EPA's conclusions regarding lead risks for the Ruston/North Tacoma site and application of the Integrated Uptake/Biokinetic Model are discussed below.

EPA believes that there is a sufficient basis for identifying a need for remediation of soil lead contamination within the Study Area. EPA makes this determination while acknowledging that there are uncertainties in lead exposure and risk estimates (as there are in all Superfund risk estimates) and some issues of source identification that are particular to lead (i.e., unlike arsenic, there are other identifiable sources for lead in urban soils). The following points are relevant to EPA's determination of a need for soil lead remediation: (1) the copper smelter was a documented source of lead releases in significant quantities, a fact supported by stack monitoring results, the decrease in ambient air lead levels during smelter worker strike periods and after cessation of smelting activities, the statistically significant correlations of soil lead with other smelter-related constituents in community soils, and the high lead levels found on smelter property; (2) the soil lead concentrations as measured in some samples in the FIR/RI data set show substantial elevation in lead levels; (3) lead concentrations in soil are believed to be long-lasting and are not expected to decline substantially over even long periods of time (decades); (4) the smelter originally operated as a lead smelter and can be assumed to have had substantial lead releases during that early period of its history; (5) the EPA uptake biokinetic model shows potentially unacceptable exceedances of a blood lead criterion level of 10 μg/dl, and those results are not inconsistent with recent blood lead monitoring results in other western Washington communities (see the discussion below).

The fact that on a property-specific basis lead sources other than the smelter could be involved is recognized by EPA. Nonetheless, the overall pattern of soil lead contamination within the Study Area is believed to identify the smelter as a significant source of the current soil lead contamination documented in the RI Report. Lead from gasoline and from painted outdoor surfaces of houses is generally found in highest elevations within a few feet of major roadways or building foundations; contributions to other areas are likely to be far lower. Soil sampling in the Ruston/North Tacoma Study Area avoided locations near roadways and building foundations to the extent possible, and therefore likely reduces (but does not completely eliminate) the effects of those other major lead sources on measured values. Average urban soil lead values at locations other than adjacent to building foundations or near major roadways have been found to be far lower than the values cited by the commentor.

The relatively low current ambient air lead concentrations are not an indication that lead risks are below a level of concern, as claimed in the comment. The primary concern for the risk assessment is ingestion rather than inhalation pathways of lead exposure. House dust lead concentrations have been shown in other studies to be elevated (e.g., compared to background soil values) even where ambient air lead concentrations are low; this reflects different lead sources and transport pathways.

As discussed in the risk assessment, EPA does not find the one site-specific blood lead monitoring study from the 1970s, in which overall levels were high compared to current levels of concern, to be very useful for the current risk assessment. The recent blood lead survey in western Washington ("The Problem of Lead Exposure and Toxicity: The Status of Washington State", Batik et al. 1992) did not include the Ruston/North Tacoma population and therefore does not provide site-specific information. Other aspects of that recent survey are discussed below.

The EPA uptake biokinetic model for lead provides estimates of exceedance probabilities for defined blood lead criterion levels based on various exposure and population variability parameters. The fact that monitored blood lead levels in populations within western Washington reflect a distribution shifted somewhat lower than an independently estimated national distribution does not by itself mean that the model is overestimating blood lead levels for Washington populations; exposure levels for western Washington could, for example, be lower than the national average exposures. Such differences can be incorporated into applications of the model. The estimated dietary intake of lead in young children has been reduced in recent years; however, the version of the uptake biokinetic model used for the Ruston/North Tacoma Baseline Risk Assessment already accounts for the reduced estimate of dietary lead intakes. EPA does not find supporting information for introducing region-specific background values (e.g., lower dietary lead intakes) for western Washington applications of the uptake biokinetic model.

To evaluate the performance of the model for the recent lead monitoring results cited by the commentor, EPA has run the model using default background parameters as follows: (1) outdoor air lead concentration of 0.04 $\mu g/m^3$, and indoor air at 80 percent of outdoor air; (2) drinking water at 4 μg/l lead; (3) paint contribution of 0 μg/day lead; and (4) default dietary lead intakes by age as included in the model. All other exposure parameters (e.g., exposure frequency and duration, absorption, and contact rates) and the population Geometric Standard Deviation value were left at model default values. The soil/dust lead concentrations were assumed to be equal and allowed to vary. The exceedance probabilities were then calculated for children ages 0-6 years, as was done in the Baseline Risk Assessment. For model soil/dust lead concentrations of 100 and 200 ppm, the resulting percent exceedances of a blood lead level of 4 μg/dl were 6.8 and 26.8 percent, respectively.

Thus, if the average soil lead concentrations for the areas in which the monitored children lived were as high as 200 ppm, or even somewhat higher, the cited finding that 70 percent of the values were not detected at 4 µg/dl would be fully consistent with the model results using existing background parameters. (The estimated geometric mean values and percent of blood lead values above 10 µg/dl are also consistent with soil/dust levels at or somewhat above 200 ppm). Soil and dust lead levels varied, probably substantially, for the subjects included in the recent blood lead monitoring survey (Batik et al. 1992, provided as Exhibit F of Asarco's comments on the Proposed Plan). The majority of subjects were from Seattle. While the actual soil lead levels were not reported for this survey, EPA does not find it unreasonable that the average (geometric mean) values were in the general range of 200 ppm; an estimated urban background value of 250 ppm was in fact used in the Baseline Risk Assessment. Moreover, differences in the sources of lead and consequent bioavailability of lead from soils (e.g., differences between smelter emissions and paint as sources of lead) may be important to consider; with lower bioavailabilities, higher soil lead concentrations would be consistent with the model. EPA concludes that the results of the uptake biokinetic model using background exposure parameters do not indicate an inherent need to modify the model for use in estimating risks in the Ruston/North Tacoma Study Area.

EPA notes that the final sentence in the comment appears to be misstated. If background lead exposures are in fact overestimated, the allowable increment from site-specific soil/dust lead exposures (to reach a defined blood lead criterion value, for example 10 µg/dl) will be smaller, and the remediation goal for soil lead would consequently be reduced, not "inflated".

28. COMMENT: Page 4 of the Proposed Plan mentions that EPA estimates the long-term exposure to soil and dust with 800 ppm of arsenic could result in up to two additional cases of skin cancer for every 1,000 people exposed. This statement is misleading. Such an incidence would occur if all 1,000 people had conservative RME intakes, 80 percent absorption of arsenic, and were in the minority of the population who were unable to detoxify arsenic. These conditions are not the case for the Ruston community.

RESPONSE: There is a distribution of risks, rather than a single unvarying risk, for individuals living within the Study Area. That distribution of risks results from the fact that there will be short-term and long-term variations in the levels of exposure for different individuals (e.g., based on where they live and on their activities), as well as the fact that individual differences in biokinetics and susceptibility will exist. The statement that long-term exposure to soil and dust with 800 ppm of arsenic could result in up to two additional cases of skin cancer for every 1,000 people exposed is an expression of the risk level (i.e., a translation of the numerical cancer risk **for an RME individual** of 5×10^{-4}) for the RME case as described in the Baseline Risk Assessment.

The RME case represents an estimate of a selected point in the distribution of risks across the population of the Study Area, namely an upper percentile value that is likely to be exceeded by only a small percentage of the total exposed population. The RME case does not attempt to convey information on the distribution of risks, nor should it be used to calculate a population incidence of adverse health effects (e.g., cancer) across the Study Area. The Baseline Risk Assessment includes evaluations of other percentiles of the soil arsenic distribution to provide some additional information on possible differences by location in arsenic exposures.

The commentor is correct that the risk statement of "2 cases of skin cancer per 1,000 people exposed" refers to persons exposed according to the RME assumptions. In attempting to provide the RME risk estimates in more understandable language, there is a potential problem of confusing point estimates of individual risk with population incidence estimates. Consistent with its risk assessment guidance, EPA's evaluations of potential risks for the Ruston/North Tacoma Study Area focus on **individual risks**, not population risks.

The final EPA Guidelines for Exposure Assessment were promulgated (57 Federal Register 22888 et seq.; May 29, 1992) after issuance of the Baseline Risk Assessment for the Ruston/North Tacoma

Study Area. Those guidelines note the importance of distinguishing between variability in exposures within a population and uncertainties in selected estimates of exposure (e.g., RME estimates); see section 6.3 of the final guidelines. That same distinction was identified and discussed in the Baseline Risk Assessment for Ruston/North Tacoma (see Chapter 8, page 8-2, and Appendix H, page H-5).

Asarco has commented on several occasions on both the variability and uncertainty of exposure estimates. EPA believes it is very useful to distinguish these issues. Selection of the RME case as a basis for evaluating the need for remedial actions at a site and for development of remediation goals is an EPA risk management decision. Uncertainties in the RME estimates (e.g., questions over relative bioavailability factors, soil/dust contact rates, and so on) are addressed within the risk assessment. Those uncertainties are one factor that was considered in EPA's development of remediation goals for the Study Area. The variability in exposures across the Study Area population and the overall incidence of adverse health effects in the Study Area population did not affect the selection of remediation goals. EPA believes that risk estimates were evaluated appropriately and consistently with agency guidance in reaching decisions for the Study Area.

29. COMMENT: Page 10 of the Proposed Plan states that EPA's exposure estimates for arsenic are consistent with the highest urinary levels in the most recent community monitoring study. The study referenced by the EPA risk assessment was conducted in 1987 and does not appear to be representative of present conditions. The EPA justified their calculations based on limited urinary data on children ages 7 to 8 years old. Urinary data on those age 0 to 6 indicated that EPA exposure assumptions overestimated exposure. In addition, the sample size of children age 7 and 8 was small (15 children, 2 samples per child). The two highest urinary arsenic samples were within this group which could have been caused by sampling error. Consequently, the actual 95th percentile urinary value may be considerably lower for this group, which would thereby result in a lower estimate for soil concentration.

RESPONSE: EPA has commented elsewhere on the limitations of the recent TPCHD urinary arsenic monitoring (during 1992) and reiterates that those recent data cannot be used to characterize the current status of the population of young children living near the former smelter site. (See the responses to comments 8 and 21 in this section, above).

The evaluation in the Baseline Risk Assessment of the 1987 urinary arsenic survey data provided calculations based on the different soil/dust contact rates assumed for children ages 0-6 years and ages 7-8 years (200 mg/day and 100 mg/day, respectively). The results cited in the Baseline Risk Assessment make clear that the back-calculations for soil arsenic concentration based on exposure assumptions for ages 0-6 years would be lower than those for ages 7-8 years. EPA believes it is appropriate to consider the 1987 urinary arsenic data as a single data set. However, EPA notes that if the two age intervals are treated separately as the comment suggests, nonparametric estimates of the 95th percentile urinary arsenic values for the younger and older age groups would be 53 μg/l and 91 μg/l, respectively (based on 142 and 30 urinary arsenic measurements in the two groups). Maximum urinary arsenic concentrations are 71 μg/l and 100 μg/l, respectively. While the back-calculated soil arsenic concentration for the younger age group at its 95th percentile value of 53 μg/l is approximately the same as the value given in the Baseline Risk Assessment, the soil arsenic concentration calculated from the higher 95th percentile value for the 7-8 year old children would be greater than 1,100 ppm. These variable results are likely to reflect both the limited precision in the comparative assessment of urinary arsenic data and modeled exposure estimates and the variability in behaviors leading to contact with soil contaminants. The uncertainties in exposure estimates are already noted in the Baseline Risk Assessment and were considered by EPA in the development of soil remediation goals for the Study Area.

EPA further notes that if the distribution over time of urinary arsenic levels within an individual is positively skewed (e.g., lognormal rather than normal), then small sample sizes are likely to under-represent the high upper tail values and consequently the 95th percentile values would be underestimated. Sampling errors can be either positive or negative with respect to such point estimates, but they are not necessarily evenly matched (i.e., there may be a bias for the sample as a whole). The fact that, unlike the earlier Exposure Pathways Study, the 1987 urinary arsenic survey found the highest values in children 7 and 8 years of age is an interesting finding. It is noted that the two highest values occurred in different children, living at different locations. EPA is not aware of any information that calls into question those higher values, or suggests a sampling error or bias in their collection. The mere fact that the highest values in 1987 occur in an older age group of children, compared to earlier studies, does not invalidate them.

A recent University of Washington master's thesis (Robert Lee, 1993) also investigated the consistency of urinary arsenic data from the 1987 study and exposure estimates, using a Monte Carlo approach for exposure estimates. Based on a recent presentation by the author to EPA risk assessment staff, EPA believes the results of that study also support a finding that the urinary data and exposure estimates are generally consistent.

30. COMMENT: The 1987 urinary arsenic data from children in the area within a half mile of the site also indicate that the exposure assumptions overestimate exposure and risk to children (ages 7 and 8). The children from the urinary arsenic study lived within a half mile of the site where arsenic soil levels are highest. The actual 95th percentile level for the area within a half mile of the site would consequently be higher than the 800 ppm which was based on the whole Study Area within approximately one mile from the site.

RESPONSE: EPA has reviewed the 1987 urinary arsenic survey data ("Urinary Arsenic Survey, North Tacoma, Washington", Tacoma-Pierce County Health Department, December 1988) and the combined FIR and RI soils data sets (see RI Report) to evaluate this comment. Based on that review, EPA continues to believe that the 1987 urinary arsenic data are generally consistent with the RME exposure estimate from the Baseline Risk Assessment. A summary of this review of the data is provided below.

The 1988 TPCHD report on the 1987 urinary arsenic survey describes the area for the study to be "all households within a 0.5 mile radius of the Asarco smelter". The actual street boundaries for the Study Area are also given: "The boundaries were North 46th Street on the south, Bristol Avenue on the West, Gove Street on the east and Point Defiance Park on the north". Based on Figure 1b (Study Area) included in the 1988 TPCHD report, this defined Study Area in fact extends well beyond a distance of 0.5 miles from the smelter, and beyond the Ruston city limits. The latter fact is important because the density of soil sampling locations is greater within Ruston than outside of Ruston (see, for example, Figure 4-3 of the RI Report).

The area within a distance of 3,600 feet from the center of the converter building is a good approximation of the Study Area actually included in the 1987 urinary arsenic survey. Soils data from all FIR and RI sampling locations within 3,600 feet of the center of the converter building (N = 201) were therefore used to estimate soil distributions within the area of the 1987 urinary arsenic survey. Estimated (nonparametric) 90th and 95th percentile arsenic concentrations are 703 and 960 ppm, respectively. Because the density of soil sampling is greater within Ruston, and because soil arsenic concentrations generally decline with distance, these are likely to be overestimates for the urinary arsenic Study Area (due to sampling bias). Moreover, the distribution of locations where subjects sampled in the 1987 urinary arsenic survey lived compared with the locations of FIR/RI soil sampling shows that the two data sets are not well-matched for location. Urinary arsenic subjects do not show a higher density within Ruston versus areas outside of Ruston within the 1987 Study Area; in fact, the reverse appears to be the case. (Compare Figure 5 of the 1988 TPCHD report versus Figure 4-3 of the RI Report). Therefore, the distribution of soil arsenic concentrations at the residences included in the 1987 urinary arsenic survey is likely to be shifted lower than the distribution of available soil sampling results for the total urinary arsenic Study Area. This would also indicate that the stated (empirical) 90th and 95th percentile estimates of 703 and 960 ppm are overestimates for the population studied in 1987. Since soil samples were not collected as part of the 1987 urinary arsenic survey, the degree of overestimation has not been quantified.

This evaluation indicates that the 95th percentile value for the soil arsenic concentration representative of the urinary arsenic survey data set is marginally, if at all, elevated above 800 ppm. That 800 ppm concentration also appears in any case to be well above a 90th percentile value. The evaluation of the consistency of the 1987 urinary arsenic monitoring data with risk assessment exposure estimates is general rather than precise (as discussed in the Baseline Risk Assessment). There are numerous assumptions required to make the comparison, and the results of a point-in-time urinary arsenic survey (with potential bias in subjects participating versus not participating) are not definitive. Uncertainties in the assumptions made in the calculations and variability in the monitoring data are recognized and limit the precision possible in the comparison of exposure estimates and biomonitoring results. The potential small differences in a 95th percentile soil arsenic concentration matched to the 1987 urinary arsenic data set, compared with the value of 800 ppm for the entire Study Area, are in EPA's view minor and do not affect EPA's conclusion that the 1987 urinary data are generally consistent with the RME exposure estimate.

FIGURES

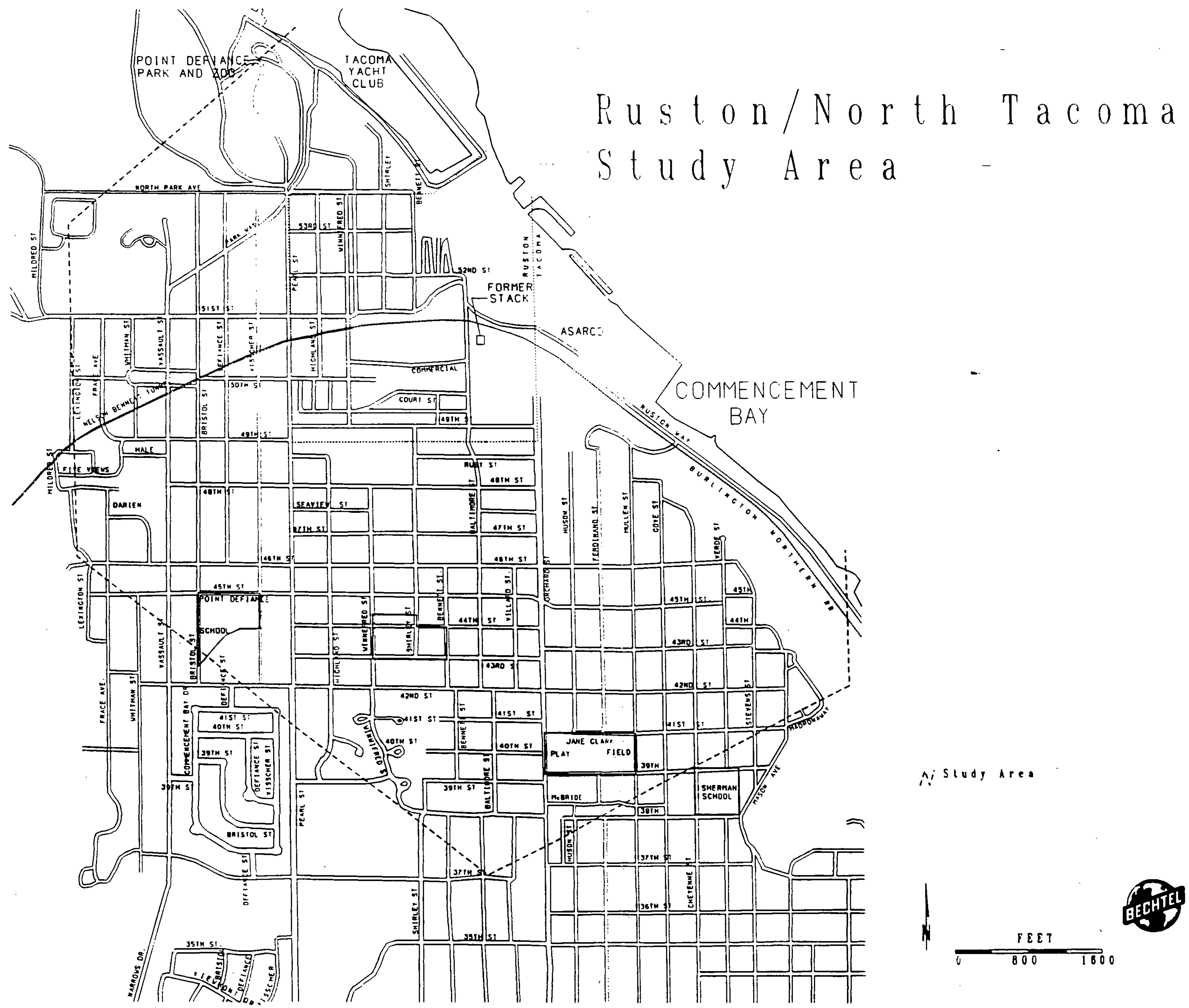
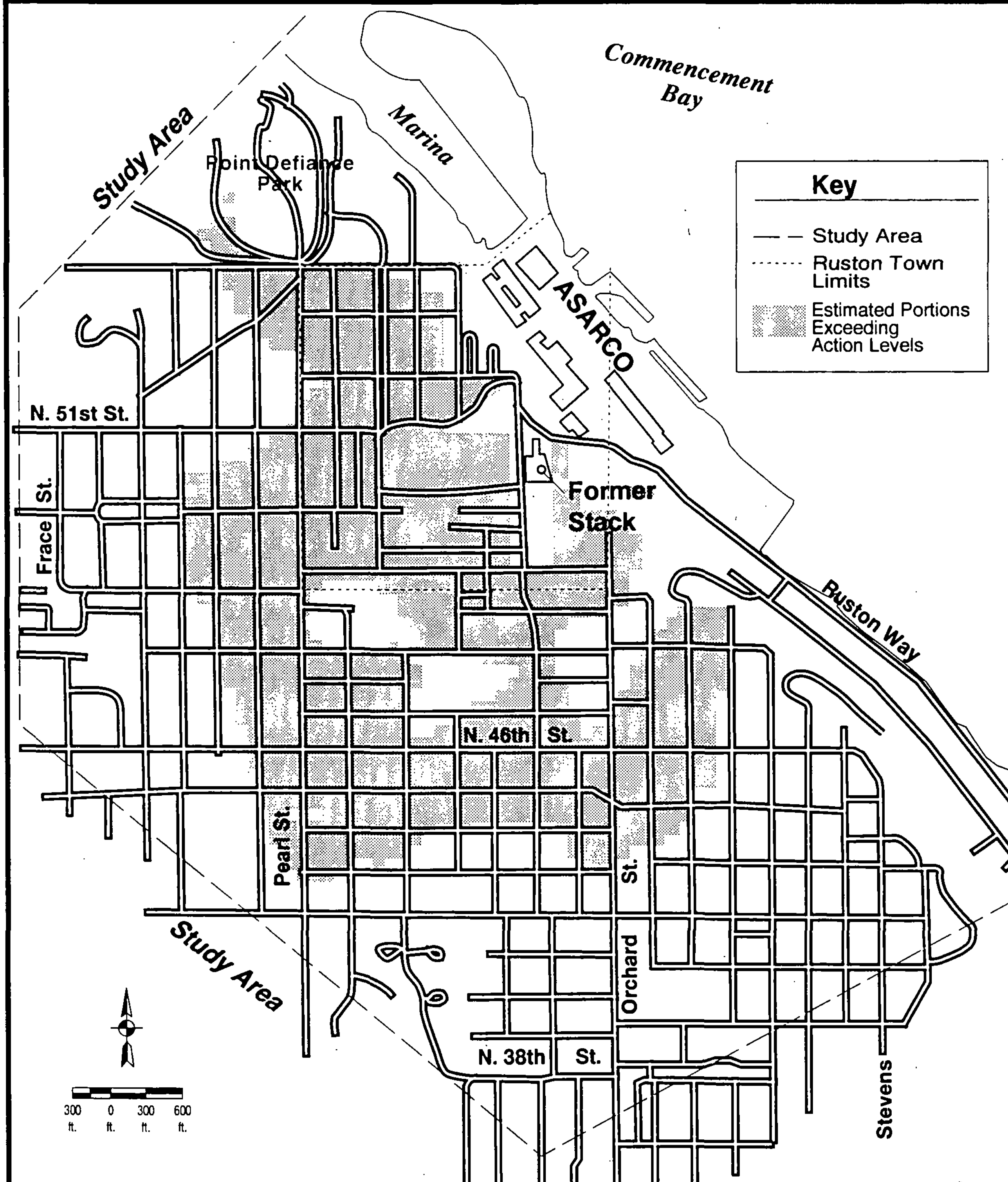

Ruston/North Tacoma Study Area
POINT DEFIANCE PARK AND ZOO
TACOMA YACHT CLUB
NORTH PARK AVE
FORMER STACK
ASARCO
COMMENCEMENT BAY
RUSTON WAY
BURLINGTON NORTHERN RR
RUSTON
TACOMA
POINT DEFIANCE SCHOOL
JANE CLARK PLAY FIELD
SHERMAN SCHOOL
McBRIDE
Study Area
FEET
0
800
1600
BECHTEL

FIGURE 1

Figure 2:
Study Area and Estimated Portions Exceeding Action Levels



TABLE

Table 1
RUSTON/NORTH TACOMA STUDY AREA
INFORMATION REPOSITORIES

Study Area	Address
In Tacoma:	McCormick Regional Branch Library 3722 North 26th (206) 591-5640 Tacoma Public Library, Main Branch * 1102 Tacoma Avenue, NW Room (206) 591-5622 City of Tacoma Environmental Commission 747 Market Street, Suite 900 (206) 591-5310 Tacoma Pierce County Health Dept. 3633 Pacific Avenue (206) 591-6553 Pacific Lutheran Library 121st & South Park Avenue (206) 535-7500 Citizens for a Healthy Bay 771 Broadway (206) 383-2429
In Ruston:	Ruston Town Hall 5117 North Winnifred (206) 759-3544
In Seattle:	U.S. Environmental Protection Agency * 1200 Sixth Avenue 7th Floor, Records Center (206) 553-4494
In Olympia:	Washington Department of Ecology 4415 Woodview Drive, S.E. (206) 438-3017

* The Administrative Record for the Ruston/North Tacoma Study Area is available at these two locations.

ATTACHMENT 1

ICF Technology Incorporated

NSI Technology Services Corporation

The Bionetics Corporation

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The Bionetics Corporation
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Report on the X-ray Fluorescence Survey of the Split Samples from the ASARCO Ruston Superfund Site

DATE: January 9, 1991

TO: Don Matheny, QA Office, USEPA Region 10

FROM: Clark D. Carlson, Chemist, ESAT, Region 10 CDC

SUBJ: Results of the XRF Spectroscopy survey for the ASARCO Split samples

TID Number: 10-9003-353

ESAT Document Number: ESAT-10a-230

This report will cover the findings of the x-ray fluorescence spectroscopy(XRFS) survey of the samples obtained from the ASARCO superfund site. Measurements were performed on the following samples: 90254867, 90254868, 90254869, 90254870, 90254872, 90254873, 90254874. 90254876, and 90254877. Mercury was observed in all of the samples with antimony and cadmium showing up in sample 90254872. Copper, lead and chromium were also observed in some of the samples. Due to the nature of the calibration and limitations of the instrumentation, the values herein should be regarded as estimates.

Experimental

The instrument used for this study was an Outokumpu Electronics X-MET 880 x-ray fluorescence spectrometer with a dual source probe containing ^{244}Cm and ^{241}Am as the excitation sources. Both the ^{244}Cm and ^{241}Am sources were used for the excitation of the elements of interest in this survey. The elements that were screened for at this site were arsenic, copper, lead, mercury, cadmium, silver and antimony. Since the instrument is capable of screening for up to six elements at a time, two models were necessary, one was used for the higher energy spectra (those elements requiring excitation from the ^{241}Am source) and the other for the lower energy spectra.

Calibration

The calibration samples were prepared from soil samples that were obtained at the site. Since none of the contaminated soil was available, the calibration samples were prepared by spiking the background soil with the appropriate oxides and nitrates. A control sample was then analyzed by normal laboratory techniques and used to insure the stability and accuracy of the calibration. Twenty samples with concentrations ranging from zero (< 100 ppm) to 20000 ppm were prepared to be used for the calibration of the instrument. The soils were prepared by sieving through a 2.0 mm sieve to obtain samples as similar to the field samples as possible. The twenty samples were then analyzed with the XRFS to give the spectra for each of the samples. The intensity data was then fit using linear regression to give the correlation between concentration and intensity. All of the elements gave a correlation coefficient for the line of greater than 0.990. The reading from all of the samples were used for the determination of the intensity/concentration correlation in every case.

The detection limits for this calibration were determined by measuring the "clean" soil sample ten (10) times at 200 seconds each to obtain the relative deviation of the intensity data. This data was then multiplied by three, giving a confidence of 95%, to give the detection limit of the model in intensity units(counts per second). This number was then placed into the equation obtained from the calibration to give the detection limit in units of concentration. The detection limits were determined to be as follows: Pb - 100 ppm, As - 80 ppm, Cu - 80 ppm, Hg - 240 ppm, Cd - 80 ppm, Ag - 100 ppm, and Sb - 100 ppm.

Due to all of the limitations of the technique, the values stated here should be considered as estimates.

Measurements

All of the measurements were taken for 200 seconds with three readings of each sample for each of the models used. The standard deviation given is the deviation among the three values and σ is the error for the counting statistic. The samples were all ground to 2.0 mm before measuring to minimize particle size affects in the results. Control samples were measured at the beginning and the end of the sampling. The concentrations of the elements in the control sample used were verified by inductively coupled plasma-atomic emission spectroscopy (ICP-AES) and were at concentrations of approximately 5000 ppm, which was the midpoint of the calibration range. All of the control readings were within 10% of the determined value.

Results

This section will describe the results for the analysis obtained from the XRF spectrometer. The average concentration is the average of the three readings taken at each node. The standard deviation is the deviation among those three values and σ is the standard deviation due to the counting statistic. The σ value is the deviation due to the method of counting the x-rays emitted by the excited elements.

Table I Sample 90254867

Element	Ave. Conc. ppm	Std. Dev. ppm	σ ppm
As	--	--	60
Cu	--	--	60
Pb	--	--	90
Hg	3620	60	210
Cd	--	--	30
Ag	150	30	60
Sb	--	--	60

Table II Sample 90254868

Element	Ave. Conc. ppm	Std. Dev. ppm	σ ppm
As	--	--	60
Cu	1090	10	60
Pb	770	50	90
Hg	3780	90	210
Cd	--	--	30
Ag	200	20	60
Sb	--	--	60

Table III Sample 90254869

Element	Ave. Conc. ppm	Std. Dev. ppm	σ ppm
As	--	--	60
Cu	--	--	60
Pb	--	--	90
Hg	2330	40	210
Cd	--	--	30
Ag	--	--	60
Sb	--	--	60

Table IV Sample 90254870

Element	Ave. Conc. ppm	Std. Dev. ppm	σ ppm
As	--	--	60
Cu	1060	10	60
Pb	940	30	90
Hg	4690	60	210
Cd	--	--	30
Ag	200	10	60
Sb	--	--	60

Table V Sample 90254872

Element	Ave. Conc. ppm	Std. Dev. ppm	σ ppm
As	--	--	60
Cu	--	--	60
Pb	--	--	90
Hg	3440	50	210
Cd	9100	70	30
Ag	200	30	60
Sb	6890	20	60

Table VI Sample 90254873

Element	Ave. Conc. ppm	Std. Dev. ppm	σ ppm
As	--	--	60
Cu	510	20	60
Pb	320	40	90
Hg	3480	50	210
Cd	--	--	30
Ag	170	20	60
Sb	--	--	60

Table VII Sample 90254874

Element	Ave. Conc. ppm	Std. Dev. ppm	σ ppm
As	450	20	60
Cu	2730	30	60
Pb	860	40	90
Hg	2820	180	210
Cd	--	--	30
Ag	160	10	60
Sb	--	--	60

Table VIII Sample 90254876

Element	Ave. Conc. ppm	Std. Dev. ppm	σ ppm
As	2720	20	60
Cu	1980	70	60
Pb	940	20	90
Hg	1990	70	210
Cd	--	--	30
Ag	140	30	60
Sb	--	--	60

Table IX Sample 90254877

Element	Ave. Conc. ppm	Std. Dev. ppm	σ ppm
As	410	10	60
Cu	580	10	60
Pb	--	--	90
Hg	2420	80	210
Cd	--	--	30
Ag	--	--	60
Sb	--	--	60

Discussion

The results obtained from the XRFS screening seem to indicate that there is a definite problem with contamination at the site. The comparison with the laboratory data will prove to be quite interesting. Of the data presented here, the mercury data may be the most suspect. The reason for this being that overlap of signals from other elements sometimes causes a problem in readings for mercury. It also appears that spiking a sample with mercury does not always show the same matrix affects as contaminated soils. It must once again be stated that these values should be considered as estimates due to the limitations of the methods used.

ATTACHMENT 2

United States
Environmental Protection
Agency

Region 10
1200 Sixth Avenue
Seattle WA 98101

Alaska
Idaho
Oregon
Washington

EPA

August 13, 1992

Reply To
Attn Of: HW-113

Mr. Thomas L. Aldrich
Site Manager
ASARCO Incorporated
P.O. Box 1677
Tacoma, WA 98401

Dear Mr. Aldrich:

This letter is written in response to your letter dated April 17, 1992 that included comments on the Ruston/North Tacoma Baseline Risk Assessment, Remedial Investigation, Feasibility Study, and Decision Memorandum. The Environmental Protection Agency (EPA) appreciates the interest and participation of ASARCO Incorporated (Asarco) in this matter. EPA believes that the following responses comprehensively address the significant concerns raised in Asarco's comments. EPA also refers you to section (F) of the Proposed Plan for the Ruston/North Tacoma Study Area which responds to Asarco's comments as summarized in its Community Update for June 1992.

The organization of this response letter generally matches the format presented in your letter dated April 17, 1992. In response to the general comments presented on page 2 of your letter, EPA does not agree that the record compiled by EPA does not support widespread remedial action throughout the community. EPA believes that the extensive investigation and analysis reflected in the above-referenced documents demonstrate that arsenic and lead contamination in the Study Area presents a threat to human health and the environment that, under the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), requires a "widespread" remedial action. EPA also believes that it has followed all appropriate requirements and guidance in developing its documents and the Proposed Plan. Your specific comments on EPA's documents are addressed in detail as follows:

A. Baseline Risk Assessment and Epidemiological Studies

Asarco's Comment: *Asarco states that "Further remedial action in the Ruston/North Tacoma study area is not necessary to prevent, minimize, or mitigate threats to the public health or welfare. None of the studies, reports, and documents relied upon by EPA demonstrate that conditions in the study area exert* *adverse effects, or present a threat, to public health or welfare."*

Asarco gives two major reasons in support of this statement:

(1) The Baseline Risk Assessment conducted by EPA for the Ruston/North Tacoma Study Area was not written using "proper application" of the EPA's own guidelines and is overly conservative so that it "impermissibly overstates the theoretical risks to the community." "ETI performed a risk assessment for the study area following EPA guidelines, and concluded that no further remediation is necessary for protection of public health."

(2) "Every epidemiological study which has examined the potential effects of the Tacoma smelter on the community has concluded that there is no evidence of adverse health effects....The Baseline Risk Assessment and the Decision Memorandum go to great lengths to eliminate these studies from further consideration."

EPA's Response: EPA disagrees with Asarco's comment on the conduct of the baseline risk assessment. Following is a description of how EPA's baseline risk assessment was completed in accordance with EPA's requirements and guidance and also a discussion of how EPA considered epidemiological and other health studies.

(1) EPA's Baseline Risk Assessment.

(a) EPA Guidance. EPA disagrees with Asarco's assertion that EPA guidance was not followed in performing the baseline risk assessment for the study area.

The baseline risk assessment is performed as a part of the Remedial Investigation to determine whether the contaminants of concern identified at the site pose a current or potential risk to human health and the environment in the absence of any remedial action. The Superfund baseline risk assessment process consists of exposure assessment and toxicity assessment components, the results of which are combined to develop an overall characterization of risk. The uncertainties in the assessments done for exposure and toxicity are also discussed.

In developing the baseline risk assessment for the Ruston/North Tacoma Study Area, EPA followed the guidance provided in the preamble to EPA's National Oil and Hazardous Substances Pollution Contingency Plan (NCP: USEPA, 1990) and Risk Assessment Guidance for Superfund, Volume 1, Human Health

Evaluation Manual, Part A (RAGS: USEPA, 1989), as well as several Directives issued by the Office of Solid Waste and Emergency Response. These directives include but are not limited to "Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" (USEPA, 1991a) and "Update on OSWER Soil Lead Cleanup Guidance" (USEPA, 1991c).

(i) Toxicity Assessment. For the toxicity assessment component of the Ruston/North Tacoma Risk Assessment, EPA used toxicity information and EPA toxicity values that have undergone extensive peer review by EPA. Toxicity values provided in EPA's Integrated Risk Information System (IRIS) database were used, when available. This database contains only those toxicity values that have been extensively reviewed and verified by EPA.

The data for developing the toxicity factors or criteria for arsenic and lead, the two contaminants of most concern at the site, are from studies of humans, not laboratory animals. For example, for arsenic the toxicity values used to estimate both cancer and non-cancer effects were based upon studies of humans who consumed arsenic in their drinking water. For lead, the toxicity information used to develop a protectiveness criterion is from studies of learning and behavioral effects in children exposed to lead.

(ii) Exposure Assessment. For the exposure assessment component of the Baseline Risk Assessment, EPA used the methods described in the NCP and in the Human Health Evaluation Manual (USEPA, 1989) cited above. The NCP preamble and the Superfund guidance manual state that Superfund risk assessments should be based on the "reasonable maximum exposure" (RME) expected to occur at the site under current and future land-use conditions. The reasonable maximum exposure is defined as the highest exposure that is reasonably expected to occur at a site. The intent of the RME is to estimate a conservative exposure case that is higher than that experienced by most of the exposed population (i.e, well above the average case) and that is still within the range of possible exposures. Site remediation decisions made based on RME exposure estimates are expected to be protective for most of the potentially exposed population. RME exposure estimates are thus by definition not intended to represent typical or average exposure conditions.

EPA's Human Health Evaluation Manual provides separate equations for quantifying chemical-specific exposures for most possible exposure routes at a Superfund site (e.g., ingestion of chemicals in drinking water, soils, fish and shellfish; inhalation of contaminants in air). The parameters in these equations include:

- Body weight
- Behavior-related parameters such as exposure frequency, exposure duration, and contact rate (amount of the specific medium taken into the body, such as the amount of soil or water ingested each day)
- Chemical concentration in a given medium (e.g., soil, air, water)
- Bioavailability of the contaminant from the medium of concern (e.g., the fraction of contaminant in ingested soil that is absorbed by the gastrointestinal tract)

EPA's Superfund program has developed standard default values for many of the parameters in these exposure pathway equations (OSWER Directive "Standard Default Exposure Factors", USEPA, 1991a). This was done to ensure national consistency in the Superfund Risk Assessment process. Some of these default values are at mid-range while others are upper-bound values of their respective statistical distributions. These values were chosen so that a combination of all of the parameters in an exposure equation result in an estimate of the reasonable maximum exposure, not the worst possible exposure. This is in contrast to Asarco's assertion that EPA combines "multiple conservative assumptions" that "impermissibly overstate the theoretical risks to the community."

In EPA's Risk Assessment for the Ruston/North Tacoma study area, the methods used were those recommended by EPA guidance. The two contaminants of greatest concern in the study area are arsenic and lead. For both, the exposure pathway that is of major concern and which results in the greatest exposure and risk at the Ruston/North Tacoma study area is ingestion of soil and dust by residents, especially children.

For arsenic, the equation used by EPA for calculating exposures from ingestion of soil and dust is that provided in EPA's Human Health Evaluation Manual. For the parameters in this equation, EPA used those standard default parameters that are provided in the OSWER Directive "Standard Default Exposure Factors." These include values for exposure frequency, exposure duration, body weight and soil contact (ingestion) rate. Values for two other parameters which are site specific and are not provided in the OSWER Directive (soil and dust concentration and bioavailability) were derived following general guidance provided in the Superfund Health Evaluation Manual that requires an estimate of reasonable maximum exposure. Their derivation was based on evaluations of relevant site data, a review of current literature, and best professional judgement. The Baseline Risk Assessment report (Glass and SAIC, 1992) includes a detailed discussion of the information used to determine those exposure parameter values.

For lead, exposures are determined using a specific model developed for lead, the Integrated Uptake/Biokinetic (UBK) model. The UBK model includes default parameters developed by EPA. As discussed in "Update on OSWER Soil Lead Cleanup Guidance" (USEPA, 1991c), these default parameters are to be used at Superfund sites unless site-specific data are available. The exposure and risk assessment done at the Ruston/North Tacoma site for lead followed this guidance and used the standard default parameters provided for the model, with the exception of the use of site-specific air and soil/dust data for lead concentrations.

(b) <u>Overstating Risks</u>. EPA disagrees with Asarco's assertion that EPA's risk assessment is overly conservative and overstates risks to the public.

As discussed above, EPA used the methods described in EPA's regulations and guidance to estimate the "reasonable maximum exposure" (RME) in the study area. The intent of the RME is to estimate a <u>conservative</u> exposure case that is higher than that experienced by most of the exposed population (i.e., well above the average case) but still within the range of possible exposures. The RME exposure estimates will, by definition, overstate risks for individuals with average or typical exposures; thus, it is very important to distinguish differences at RME versus average exposures from uncertainties in the RME estimates themselves. The selection of RME exposure estimates to provide for protection of <u>nearly all</u> community residents (not just those with average exposures) is a risk management policy decision by EPA mandated by the NCP. The fact that RME exposure estimates are greater than those for the average or typical individual is thus not an "impermissible overstatement" of risks but an essential feature of risk management policy.

As discussed above, the default exposure parameters given in EPA's national guidance ("Standard Default Exposure Parameters") were selected to result in a conservative RME exposure, not one that "impermissibly overstates risks to the community." Once calculated, the RME exposure is combined with EPA toxicity values to calculate the risk for a person in the study area with the reasonable maximum exposure.

Asarco argues that the assumptions used to determine whether arsenic in soil poses a health risk are unreasonable because an individual would have to live on the same property for 30 years, eat soil and dust nearly every day, have an upper bound absorption rate for arsenic, and be among the minority of people that are unable to detoxify arsenic readily. Asarco asserts that this type of individual does not exist.

With respect to the exposure parameters mentioned by Asarco, EPA notes the following:

- Information collected by Frost et al. (1987) as part of a recent epidemiological study of the population that has lived near the Tacoma Smelter included the length of residence for individuals (women) included in the study. The <u>average</u> years of residence for subjects living within several miles of the smelter was greater than 30 years. While these data are for past years of residence, they tend to support the use of a 30-year exposure duration for an RME exposure estimate.

- Common behavior patterns will lead to some degree of <u>inadvertent</u> contact with (not intentional "eating" of) outdoor soils and indoor house dusts on a daily basis. This is especially true of young children, the population of most concern. The studies of normal populations to determine soil/dust contact rates, which are reviewed in EPA's Baseline Risk Assessment (Glass and SAIC, 1992) as well as ETI's risk assessment (ETI, 1991), have shown variable but non-zero contact rates for the subjects studied.

- As noted in the baseline risk assessment, studies by Weinshilboum (1988) on the ability of individuals to methylate different substrates in the body (e.g., drugs) have shown that there is large variablity among individuals and that this variability may be genetically inherited. His data also suggest that the general population incidence of decreased methylating capacity may be as high as 10 to 25 percent. EPA believes that this 10 to 25% of the population with a potentially reduced ability to detoxify arsenic is an important segment of the population that should be considered in estimating the RME. Studies by Foa et al. (1984) and Bettley and O'Shea (1975) provide further support for the importance of considering individual differences in arsenic metabolism. It should also be noted that as stated by EPA's Scientific Advisory Board (1989c) "because the detoxification (of arsenic) at lower doses does not appear to be more than 80-90% complete, the possibility of some risk at lower doses cannot be ignored" even for individuals who do methylate arsenic."

- EPA's exposure estimates, including an "upper bound" bioavailability (absorption) factor of 80 percent for arsenic from ingested soil/dust, were compared with the highest values (reasonable maximum exposures) from the most recent urinary arsenic monitoring study of children in the Study Area (TPCHD, 1988). Those exposure estimates were consistent with the monitoring results. EPA concludes that the cumulative assumptions included in the exposure estimates in the Baseline Risk Assessment do not "impermissibly overstate" the exposures or risks to community residents.

EPA feels that the exposure parameters and toxicity values used to estimate the RME risk in its risk assessment are the best that can be developed with existing scientific data. However, EPA also recognizes that there is uncertainty in several of these toxicity and exposure parameters. Therefore, as a part of the baseline risk assessment, EPA conducted an extensive uncertainty analysis of both the toxicity values and the exposure assumptions that were used in the baseline risk assessment. That uncertainty analysis discussed how the RME risks estimated in the EPA risk assessment could be affected by varying some of the assumptions in the exposure equation. For some parameters (e.g., duration of exposure), even relatively large decreases from the assumptions used in the RME calculation resulted in only marginal reductions in estimated exposures.

A discussion of the uncertainties in the risk assessment was also included in the "Ruston/North Tacoma Site Preliminary Remedial Action Objectives Decision Memorandum" (USEPA, Region 10, 1992). That memorandum provides a detailed discussion of how the preliminary remedial action objectives (RAOs) (clean-up goals) for lead and arsenic in the study area were developed. The uncertainties in the risk assessment were one of several considerations in selecting the preliminary RAOs for the study area.

(c) <u>ETI's (Asarco's) Risk Assessment</u>. EPA disagrees that the risk assessment conducted by Asarco's consultant ETI follows EPA guidance and should be used to conclude that no further remediation is necessary to protect public health.

ETI did not follow EPA guidance in conducting its risk assessment. For arsenic, many of the standard default parameters provided by EPA for evaluating soil/dust ingestion exposures were not used by ETI in calculating its "reasonable maximum exposure" for soil and dust ingestion. For example:

(i) Soil and Dust Ingestion Rate. EPA guidance provides a soil and dust ingestion rate for children of 200 mg/day. Several studies, cumulatively including a few hundred children, have been done to determine soil and dust ingestion rates for children. The results of these studies have shown that there is large variation in the amount of soil and dust that individual children ingest each day, with some children ingesting much larger amounts. Because of this positively skewed distribution of ingestion rates, the average soil ingestion rate calculated from these studies is larger than the median. ETI chose a soil ingestion rate of 85 mg/day using the median value of these studies. EPA feels that a value of 200 mg/day is a more appropriate value to use to estimate the exposure for a person with the reasonable maximum exposure.

(ii) Exposure Frequency. EPA guidance provides an exposure frequency of 350 days per year which assumes that a person is exposed to soil and dust every day except for two weeks spent away from home each year. This value was selected as a conservative estimate for the RME individual, especially for children. Exposure estimates for soil and dust ingestion show that a very large proportion of a person's lifetime exposure from these media occur during the first six years of life. It is during these ages (0-6 years old) when many children also spend a majority of their time at home.

The value used by ETI in its risk assessment is approximately 274 days per year for children and assumes that children are exposed 100 percent of the time in the spring and summer and 50% of the time in the fall and winter. This value is inconsistent with EPA's guidance; significantly, it does not account for exposures to house dust during fall and winter.

(iii) Soil Concentrations. In EPA's risk assessment for the Ruston/North Tacoma site, EPA assumed that the concentrations of arsenic and lead in an area about the size of a residential lot best represent the contaminant levels that individual residents will be exposed to over a long time period. This assumption was made because the size of the area that a typical community resident would contact on a frequent basis, even over a relatively long period of time, is expected to be quite small in comparison to the total study area size (950 acres), or any substantial portion of the total study area. And as discussed above, the exposures estimated for soil and dust ingestion show that a very large proportion of a person's lifetime exposure from these media occurs during the first six years of life. This is because children frequently put soil and dust-contaminated food, toys and other non-food items in their mouth. It is during these ages (0-6 years) when many children also spend a large proportion of their time playing in and around their own home and yard. The use of individual residential yard soil/dust concentrations as the appropriate representation of long-term exposures is also consistent with EPA risk assessment guidance (USEPA, 1989) for estimating the reasonable maximum exposure (RME).

The soil and dust concentration used to calculate the RME exposure in EPA's risk assessment was the 95th percentile soil arsenic concentration found in the study area (800 ppm). That is, 5 percent of the individuals in the study area would be expected to have 800 ppm or more of arsenic in their soil and house dust. (Since there is only a single measurement of soil arsenic concentration for a property, based on a composited sample, that value is assumed to represent the average concentration for the property). EPA's risk assessment also calculated risks for soil/dust arsenic concentrations at background and at the 50th ,75th, 90th and 99th percentile concentrations. These additional calculations provide information on how calculated exposures and risks can vary by location across the study area, to values less than <u>or greater than</u> the RME values.

ETI used a soil arsenic value of 204 ppm to estimate reasonable maximum exposures. This is the ETI-calculated upper confidence limit of the geometric mean of all of the soil values within 1/2 mile of the smelter. The use of this value is not appropriate for calculating the exposure for an RME individual within the Ruston North Tacoma study area. It assumes (contrary to reason) that this individual would have frequent soil and dust contact over all of the area within 1/2 mile of the smelter (several hundred acres), thereby greatly reducing the estimated exposure for individuals who have some of the higher levels of arsenic in their yard soils and dusts (e.g., the 95th or 99 percent values of 800 and 1600 ppm, respectively). The use of soil mean concentrations for such a large area as the study area is more appropriate in describing typical (median) exposures, not reasonable maximum exposures.

ETI's use of these alternative exposure parameter values (soil/dust ingestion rate, exposure frequency, and soil concentration, plus estimated lifetime) that are not consistent with EPA guidance, combined with lower estimated bioavailability and cancer potency factors for arsenic, resulted in the calculation of exposures and risks that are much less than those calculated by EPA using national guidance and default exposure parameters. Therefore, it is inappropriate to use the ETI risk estimates to conclude that "no further remediation is necessary for protection of public health."

(d) Slag. Asarco states that EPA's "analysis of risks from exposure to slag in the document is unrealistic... As documented in the Comparative Risk Assessment prepared by ETI, the risks resulting from slag exposure are likely to be minimal under the present environmental conditions in the community."

In estimating the risk from slag exposure in the study area, EPA used the toxicity values and exposure parameters provided by EPA national guidance. However, EPA guidance was not available for some of the exposure parameters that were needed to calculate risks from exposure to slag. For these parameters (e.g. bioavailability of arsenic from slag in the gastrointestinal tract, allocation of exposure taking into account the different concentrations of arsenic in slag versus house dust), the best available scientific information was used to develop values for these parameters. This resulted in estimated slag risks for the RME individual that are about one-half of those calculated for reasonable maximum exposure to soils (at 800 ppm soil arsenic).

EPA believes that the risk values calculated for slag are the most appropriate given our current knowledge about slag exposures. EPA also recognizes that the uncertainties in the slag risk assessment may be higher than those from other exposure routes considered in the study area risk assessment, like soil/dust ingestion or inhalation. As a result of the uncertainties in the slag risk assessment, which are discussed in detail in EPA's risk assessment, the actual risks from slag could be higher or lower than those estimated in the risk assessment. It is noted here that slag contains elevated concentrations of lead and other metals, but the baseline risk assessment only addresses potential arsenic exposures and risks from slag.

ETI's risk assessment of slag contains many assumptions that are not scientifically sound and that do not follow EPA guidance (e.g., for exposure duration, estimated lifetime, ingested arsenic cancer potency factor). These include insupportable adjustments made in the exposure estimates for particle sizes of slag and adherence to the hands, and the lack of consideration of tracking of slag to household dust (EPA's study at houses containing slag driveways has shown that such tracking occurs). Therefore, the risk estimates calculated by ETI for slag exposure, which are much lower than EPA's estimates, cannot be used to conclude that "the risks resulting from slag exposure are likely to be minimal."

(2) Epidemiological and Exposure Studies.

Epidemiological (health) studies of a population exposed to elevated levels of an environmental contaminant are done to determine if one or more adverse health effects can be detected in that population as a result of those elevated contaminant levels. Several epidemiological studies of the community surrounding the Asarco smelter have been carried out over the past 20 years. These include studies to determine if lung cancer deaths or adverse effects on the fetus (lower birth weights, birth defects) are at higher than normal levels in the vicinity of the smelter due to exposure to past or existing smelter contaminants. In addition, urinary arsenic sampling (a community monitoring, or exposure, study) has been performed several times since the early 1970s to determine if individuals, especially children, living in the vicinity of the smelter have elevated levels of arsenic in their urine.

EPA's Risk Assessment Guidance for Superfund (RAGS: USEPA, 1989) states that "if site-specific health or exposure studies have been identified and evaluated as adequate, one should incorporate the study findings into the overall risk characterization to strengthen the conclusions of the risk assessment." In the EPA's Baseline Risk Assessment for the study area, an entire section (Section 7) is devoted to reviewing the epidemiological and exposure (urinary arsenic monitoring) studies conducted at the site. These results were then compared to EPA's risk assessment results to ensure that the risk assessment results were not inconsistent with these site-specific studies. As noted above, the latest urinary arsenic monitoring data (TPCHD, 1988) are consistent with the RME exposure estimates in the baseline risk assessment. EPA also concluded that the available epidemiological studies do not warrant changing the estimates of risk within the risk assessment. Therefore, EPA disagrees with Asarco's statement that EPA's "Baseline Risk Assessment and Decision Memorandum go to great lengths to eliminate these [epidemiological] studies from further consideration." On the contrary, they received a detailed review and were included in the risk assessment. EPA disagrees with Asarco on the meaning of the results of those studies.

ASARCO also argues that overly conservative theoretical risks are used to discount the numerous epidemiological studies conducted at the site. In fact, the more conservative (i.e., higher) the risk estimates, the more likely it is that they would be found inconsistent with the results of epidemiological studies. Therefore, ASARCO is mistaken in believing that conservatism in risk estimates can be used to discount epidemiological results; just the opposite is true. EPA's comparison of risk and exposure estimates to commumity health and community monitoring reults was conducted specifically as a check against unwarranted conservatism. The consistency in results does not support reductions in exposure and risk estimates.

The possible adverse health effects identified in EPA's Ruston/North Tacoma risk assessment from exposures to arsenic in the study area include an increased risk for skin cancer and other skin conditions (e.g., keratosis) from ingestion of arsenic and, to a lesser extent, an increased risk for lung cancer from inhalation of soil arsenic that has been resuspended in the air. Cancers of other organs are also noted as possibly resulting from arsenic exposures (especially arsenic ingestion), although quantitative risk estimates are not available for these other cancers. Lead exposures are primarily of concern for adverse learning and behavioral effects in children. Based on the levels of increased risk calculated for ingestion of arsenic and lead in soil and dust, EPA concluded that exposures from the ingestion pathway exceed acceptable risk ranges or goals established by EPA. The projected increased risk from inhalation of arsenic at current ambient concentrations did not exceed EPA's acceptable risk levels.

As mentioned above, the epidemiological studies done in the study area include several on morbidity (e.g., birth defects, low birth weight) and on lung cancer. The results of these epidemiological studies have not shown any statistically significant increase in adverse health effects. These negative results are not inconsistent with EPA's risk assessment nor EPA's decision to take action at the site because risk levels of concern to EPA's Superfund program are generally at levels that are difficult to detect in epidemiological studies. As stated in RAGS, "the small populations and variable exposures predominating at most Superfund sites will make it extremely difficult to detect site-related effects using epidemiological techniques."

Also, it is very important to point out that <u>no epidemiological studies</u> have been done in the study area on the effects identified in EPA's risk assessment as being of the greatest concern, namely elevated incidence of skin cancer and non-cancer skin effects (e.g., keratosis) and adverse learning and behavioral effects in children.

EPA's Ruston/North Tacoma risk assessment estimated that an increased risk from lung cancer could occur in the study area as a result of exposures to arsenic in the air. An increased lung cancer risk is the only adverse health effect identified in the Ruston/North Tacoma risk assessment for which epidemiological studies have been done in the study area. Even though the results of these lung cancer epidemiological studies were negative, they were evaluated in the Ruston/North Tacoma risk assessment. This is because negative results from a well conducted epidemiological studies can be used to establish upper bounds on the risks for the health effect(s) analyzed in that study. Negative results from a well done study also show that the incidence of this particular health effect, if any, is small.

Based on this analysis of the lung cancer epidemiological study and the methods used by EPA in its risk assessment, it was concluded that lung cancer risks could be (but are not necessarily) somewhat lower than those estimated by EPA's Ruston/North Tacoma risk assessment. This conclusion is very uncertain, however, since it is based on assumptions about historical exposure data that are not available. This conclusion also does not affect EPA's decisions at the Ruston/North Tacoma Superfund site because the lung cancer risks calculated in EPA's risk assessment did not exceed the acceptable risk range established by EPA for Superfund sites.

As discussed above, urinary arsenic monitoring (exposure monitoring) has been done since the early 1970s in the Ruston/North Tacoma area as a means of evaluating community arsenic exposures. In the most recent study (TPCHD, 1988), elevated urinary arsenic levels were still observed in some children, although the general levels of urinary arsenic appear to have declined from earlier levels observed during and immediately after the period of smelter operations. In EPA's Risk Assessment for the study area, the most recent urinary arsenic data (1988) were reviewed to evaluate whether they support a lower estimate of arsenic exposure and therefore, a lower estimate of risk, than that estimated in the EPA Risk Assessment. That analysis did not provide support for reducing the RME estimate of soil and dust exposures as presented in EPA's Risk Assessment.

B. Preliminary Remedial Action Objectives

Asarco's Comment: Regarding EPA's proposed remedial action objectives (RAOs), Asarco states that "EPA then applies the already conservative assumptions in the Baseline Risk Assessment in a very conservative fashion in order to arrive at its 'action level'. The action level is used as the maximum concentration that is allowed to remain after remediation, an approach that is inconsistent with EPA guidelines."

EPA's Response: As discussed above, in estimating the risks for the Ruston/North Tacoma site, EPA assumed that the concentrations of arsenic and lead in an area about the size of a residential lot best represent the contaminant levels to which individual residents will be exposed over a long period of time. This same assumption was made in developing the RAOs for the study area.

A residential lot was chosen as the appropriate exposure area for an individual because it is expected that the size of the area that a typical community resident would contact on a frequent basis would be quite small compared to the total study area size of 950 acres, or any substantial portion of that study area. In addition, the exposures estimated for soil and dust ingestion show that a very large proportion of a person's lifetime exposure from these media occurs during the first six years of life. During these first six years, children tend to spend a large proportion of their time playing in and around their own home and yard.

The use of individual residential yard soil/dust concentrations as the appropriate representation of long-term exposures is also consistent with EPA's guidance on estimating the reasonable maximum exposure (RME). RAGS states that "averaging soil data over an area the size of a residential backyard (e.g., an eighth of an acre) may be most appropriate for evaluating residential soil pathways" (USEPA, 1989).

In EPA's Proposed Plan, soil removal would occur in those residential lots where the <u>average</u> arsenic or lead concentrations exceed the RAOs developed for these contaminants (230 ppm for arsenic and 500 ppm for lead). Soil levels that are above 230 ppm arsenic or 500 ppm lead may remain in a residential lot if the average concentration in a lot is at or below the RAOs, and if the subareas above the RAOs do not present an unacceptable exposure risk (e.g., they are not primary preferred play areas). The methods that will be used to estimate the average contaminant levels of arsenic or lead in each lot (e.g., composite versus individual sampling designs) will be developed after the Record of Decision for the study area is finalized and the remedial design work begins.

For the reasons discussed above, EPA feels that the residential yard is the appropriate area in which to apply the action level and that this approach is consistent with EPA's guidance. Asarco considers EPA's approach in setting action levels (achieving the RAOs in each yard) to be "very conservative" and "inconsistent with EPA guidelines." Asarco proposes an alternative approach to developing RAOS which would apply the action level to the entire area (several hundred acres) within one-half mile of the smelter. Remedial action at individual yards would only occur until the average of the soils in the entire area within the one-half mile radius of the smelter (or other defined zones) is at or below the designated action level. That approach would result in some yards being cleaned to background while other yards above the RAOs would not be cleaned at all. This is not consistent with EPA's regulations and guidance because it would allow risks for some individuals in the study area to be above those set by EPA guidance and regulation (i.e., some individuals would have long-term exposures to soils exceeding 230 ppm arsenic or 500 ppm lead). In addition, this approach is technically unsound because it assumes that an individual (including a child) would contact soils frequently over the entire area within one-half mile of the smelter (several hundred acres).

Asarco also states that EPA's action level is the maximum concentration that is allowed to remain after remediation. This is incorrect, since EPA's preliminary RAO is to remove contaminated soil so that the <u>average</u> levels of arsenic and lead in a yard do not exceed the RAOs, so long as remaining contaminants above the RAOs do not present an unacceptable exposure risk.

C. Remedial Investigation Report

Asarco's Comment: Asarco said that EPA has not considered community opinion adequately based on the results of a poll that Asarco conducted.

EPA's Response: EPA does listen to community concerns and has modified its plans when comments are received. Section (F) of this Proposed Plan is a summary of comments received from the public during EPA's first public comment period in February through April and an explanation of how EPA has incorporated the comments into its **Preferred Alternative.**

EPA continues to implement an extensive community outreach program -- that includes frequent mailings of fact sheets, community workgroup meetings, public meetings, presentations to meetings of the Ruston and Tacoma councils, creation of and regularly scheduled meetings with a Coordinating Forum comprised of elected and high-level management officials of the Town of Ruston, the City of Tacoma, the State of Washington Departments of Health, Ecology, and Labor and Industries, the Tacoma-Pierce County Health Department, the Metropolitan Park District of Tacoma, the Agency for Toxic Substances and Disease Registry, the Puget Sound Air Pollution Control Authority, and Asarco -- so that EPA can describe its plans to interested persons and hear directly from the residents and community representatives about its concerns and preferences.

EPA notes that Asarco did not share the results of the poll with EPA until Asarco submitted this comment. More important, however, EPA does not believe Asarco is an appropriate representative for the community's concerns and opinions other than its own. EPA believes that polls conducted by Asarco, the company that is financially liable for the cost of the cleanup, are not the most reliable method for assessing the community's concerns.

Asarco's Comment: Asarco believes that data presentation in EPA's Remedial Investigation report is misleading.

EPA's Response: EPA believes that it is not misleading to factually represent the range of arsenic and lead levels presently identified in Study Area soils.

Asarco's Comment: Asarco notes that the average of arsenic and lead concentrations throughout the Study Area is much lower than concentrations at individual properties identified by EPA.

EPA's Response: As indicated above (see section B above), EPA is concerned about the residents' exposure to their individual properties, not to the exposure resulting from a 1/2 mile area surrounding their individual property. The soil cleanup of the Study Area will be based on a statistical analysis of actual sample values obtained from each property as compared to action levels. For example, if an individual property has arsenic contamination greater than 230 ppm, EPA proposes to remove the contaminated soils. Study Area-wide averages will not be used to make determinations on soil removal.

EPA's **Preferred Alternative** focuses on the cleanup of individual properties that exceed the action levels for arsenic and lead because a resident's potential exposure to arsenic and lead primarily comes from their own property, not the Study Area as a whole.

D. Feasibility Study Consideration of Risk-Related Criteria

Asarco's Comment: Asarco comments that the Feasibility Study (FS) evaluations of remedial action alternatives with respect to overall protection of human health and the environment, long-term effectiveness and permanence, and short-term effectiveness are inadequate. Asarco states that:

> *the analysis "which is lacking [in the FS] includes quantification of residual risks, the health risks posed by excavation and transportation of soils and slag..."*
>
> *"The FS does not compare the short term risks associated with the excavation alternatives (Alternatives 3, 4, 5, and 6). These risks should be quantified and compared to the benefits of the excavation alternatives, as required by Section 121 of CERCLA."*
>
> *"To adequately evaluate the alternatives, an estimate of the risks should have been quantified so that a comparison could be made with the long-term risks associated with Alternatives 1 and 2. It is conceivable if not probable that the short term risks of the excavation alternatives outweigh the risk posed by site contamination, given the transportation elements involved, the large amounts of soil to be handled, and the lengthy time for completion."*

EPA's Response: EPA's National Contingency Plan and the EPA guidance document "Human Health Evaluation Manual, Part C: Risk Evaluation of Remedial Alternatives" (Part C: USEPA, 1991b) discuss how risk to human health is to be considered in the detailed analysis of alternatives section of the FS. Two of the nine balancing criteria assessed during the detailed evaluation -- long-term effectiveness and short-term effectiveness -- involve an evaluation of risk. In addition, these criteria are considered in evaluating a third criterion, overall protection of human health.

Part C states that "the level of effort for risk evaluations of remedial alternatives [in the FS] depends primarily on the site-specific questions that must be answered in order to select and implement a remedy...In most cases, a qualitative rather than a detailed quantitative evaluation of both long-term and short-term risks is all that is needed to select the most appropriate alternative. A quantitative risk evaluation of remedial alternatives will not need to be conducted for all sites."

In the FS done for the Ruston/North Tacoma study area (Bechtel, 1992b), six remedial alternatives were selected for detailed analysis. As described in more detail below, each of these alternatives was evaluated qualitatively to determine its impact on long- and short-term health risks and its ability to meet the criterion of overall protection of human health. A comparative analysis of all six alternatives was also done. The evaluation done in the FS followed EPA regulations and guidance and provided the information needed to select the most appropriate remedial alternative for the study area.

(1) Evaluation of Long-Term Health Risks.

Evaluation of the long-term human health risks associated with a remedial alternative involves (1) evaluating residual risk and (2) evaluating the alternative's ability to provide protection over time.

For evaluating the residual risk, Part C states that "most of the time it will be sufficient for the detailed analysis to indicate whether or not the alternative has the potential to achieve the PRGs [Preliminary Remediation Goals], rather than to quantify the risk that will remain after implementation of the alternative." In the FS, each alternative was evaluated as to its ability to reduce the health risk estimated for the study area (in the risk assessment) and to meet the preliminary Remedial Action Objectives (goals) established for arsenic and lead in the study area.

For evaluating whether or not an alternative is likely to maintain the specified protectiveness over time, Part C discusses the need for expert engineering judgement and states that "if an alternative relies on engineering or institutional controls to reduce or eliminate exposure to contaminated media then the ability of these controls to maintain protectiveness should be considered...For example, if a remedy includes capping of contaminated soils, then the potential future exposures due to cap failure include direct contact with soils and the leaching of contaminants to groundwater."

In each of the six alternatives and in a comparison of the six to each other, the ability of each alternative to maintain protectiveness over time was qualitatively evaluated in the FS. This included an evaluation of institutional controls and, for those alternatives involving soil removal/replacement and/or capping, an evaluation of the potential for exposure as a result of depth of soil excavation and cap failure. In addition, Section 2.3.2 of the FS provides a general discussion of the factors that should be considered in selecting the depth of soil excavation and of the mechanisms (physical degradation of the cap, intentional actions of residents, unintentional actions, and nondisturbance contaminant release processes) which are considered to be the most likely to result in cap failure at the Ruston/North Tacoma site. Exposures resulting from cap failure would be a result of both the mechanism that resulted in the cap failure and the level of contamination below the cap. Section 2.3.3 of the FS reviews soil capping at other metal-contaminated sites to help determine the appropriate depth for excavation and the ability of soil excavation and/or capping to maintain protectiveness.

(2) Evaluation of Short-Term Risks.

The short term health risks associated with a remedial alternative are those that have the potential to occur during implementation of the remedial alternative. The populations that may be exposed to contaminants during remediation at the Ruston/North Tacoma site include (1) people who live and work in the vicinity of the site (the community) and (2) workers who are involved in the site remediation.

(a) Short-Term Health Risks for the Community. In its comments, Asarco states that EPA should have quantified the short-term health risk for the community that could result from soil excavation and removal. These risks should then have been compared to the long-term risks associated with the two remedial action alternatives that do not require soil removal and replacement: the no-action alternative (Alternative 1) and the alternative that relies upon institutional controls (Alternative 2). The short-term health risk that is potentially of most concern for the community would result from exposure to increased levels of lead and arsenic in air as a result of fugitive dust emissions during excavation of contaminated soil.

Part C states that EPA "may choose to characterize the short-term risks to the community quantitatively for some sites and qualitatively for others. When short-term risks are not expected to be a problem for a site, a more qualitative evaluation generally is appropriate... A quantitative evaluation of short-term risks is most likely to be useful when the types, levels, and/or availability of hazardous substances are expected to change significantly as a result of remediation."

The potential for short-term risks as a result of exposure to contaminants in fugitive dust during excavation was evaluated qualitatively in the FS for each alternative that includes excavation. In addition, the magnitude of these risks was compared for the different alternatives (e.g., risks could potentially be greater in alternatives requiring more extensive excavation since more fugitive emissions are possible). This qualitative evaluation is appropriate for the Ruston/North Tacoma FS because short-term risks resulting from excavation are not expected to be a problem for the site. This conclusion is based upon experience at other hazardous waste sites where soil removal in residential areas was conducted as a part of the clean-up. The experience from these sites has shown that when appropriate management practices (e.g.,dust control and safety practices) are implemented as part of excavation, short-term exposures and risks are eliminated and/or minimized.[1]

For example, residential soil removal has occurred at the Bunker Hill Superfund Site in Idaho (Ecology and Environment, 1990, 1991), the Billings Smelter Site in New Mexico (USEPA, Region 6, 1991), and the East Helena Superfund site in Montana

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[1] In Exhibit H to its comment letter dated April 17, 1992, Asarco stated that the amount of water required to control dust would be a significant problem during dry weather periods if water use restrictions are imposed on the community in order to preserve the drinking water supply. EPA does not agree that the quantities of water that would be necessary for dust would imperil the drinking water supply. EPA further notes the Study Area residents are exempt from the City of Tacoma's current restriction on watering lawns because of Tacoma's recognition that watering lawns is an effective interim measure for dust suppression.

(USEPA, Region 8, 1992) as a result of contamination of the soil with lead and other metals. The soil removal at the East Helena Superfund Site has been performed by the responsible party, Asarco. For some of these sites, there is likely to be a greater potential for short-term risks from excavation than at the Ruston Superfund site because during the time when excavation was occurring, soils were generally drier and more easily resuspended than those in Ruston. Also, ground cover at some of these sites is less than that in Ruston, and lead contaminant levels are higher. At all three sites, management practices such as soil wetting were employed to reduce dust generation. Also, air monitoring was done for lead, and in some cases for other metals, during the excavation actions to evaluate the effectiveness of the dust suppression methods and to ensure that exposures to residents and workers were minimized. The results of both visual inspections and ambient air monitoring showed that the dust suppression methods were very effective in controlling contaminant emissions.

For example, at the Billings Smelter Site where lead soil levels were as high as 8000 ppm (compared to a high of 2700 in the Ruston Study Area), all of the air samples (20- to 48-hour sampling time periods) collected and analyzed during the excavation were well below EPA's National Air Quality Standard (NAAQS) for lead (USEPA, Region 6, 1991). EPA's NAAQS for lead is based on air data averaged over a 3 month period. Therefore, comparing short-term air lead data (20 to 48 hours) to the NAAQS for lead is a conservative overestimate of the actual exceedance of the NAAQS.

At the Bunker Hill Superfund Site, soil removal in residential areas occurred over the summers of 1989 and 1990. Lead levels in soil were as high as 14,200 ppm. Ambient air monitors were placed as close to the excavation areas as possible without creating a hazard to the workers. A comparison of the adjusted 24-hour air monitoring data (8-10 hour sampling periods adjusted to 24 hour averages) to the lead NAAQS showed that the NAAQS was not violated in either the 1989 or the 1990 removals (Ecology and Environment, 1990, 1991).

An evaluation of the air monitoring data collected by Asarco at the East Helena site remediation (USEPA, Region 8, 1992) is more difficult because the smelter is still operating and the air emissions from the smelter have resulted in elevated levels of lead in air. However, a comparison of the air data collected before remediation began and that collected during remediation led the EPA, Region 8, to conclude that there does not appear to be an increased level of lead or particulates in the air as a result of soil remediation. This conclusion is supported by visual inspections which show that resuspension of dust is being effectively controlled at the site.

If soil removal is implemented as a part of the remedial action at the Ruston/North Tacoma Superfund study area, the management practices that have been found to be most useful at other residential sites where soil was removed will be considered for implementation in the study area. These will include but not be limited to dust control and safety measures such as: wetting soil before excavation, lining and covering truck beds when transporting contaminated materials, cleaning truck wheels before they leave the excavation area, and selecting truck routes that will minimize disruption to the community. Also, air monitoring will be required during soil removal and replacement actions to provide information on the effectiveness of control measures.

(b) <u>Short-Term Health Risks for Workers</u>. For remediation at a site like the Ruston/North Tacoma study area, the two types of risks of concern at the site itself for workers are (1) the potential for exposure to arsenic and lead during excavation and (2) the potential for injury due to physical hazards (e.g., heat stress, utility line contact, excavation equipment). Part C states that "for many types of sites and remedial alternatives, the risks to workers will be well characterized and will not require much additional site-specific analysis. These issues [risks] will be addressed in more detail in the site-specific health and safety plan. <u>Thus, a qualitative assessment of worker risk is appropriate for most sites during the FS.</u>"

In the Ruston/North Tacoma FS, the potential for both types of short-term worker risk was evaluated qualitatively for each alternative. The FS identified the short-term risks that were possible given the type of remediation that might be conducted in each alternative (e.g., exposure to contaminants and the possibility of physical hazards, such as those that could result from damage to underground utility lines). The FS also states that risks to workers are anticipated to be mitigated through the use of standard health and safety practices, as discussed in Part C. A comparison among alternatives of potential short-term worker risks was also done. This qualitative evaluation is in compliance with the guidance provided by EPA in Part C.

It is also important to point out that experience from other sites where soil removal has occurred has demonstrated that short-term worker risk can be minimized and worker protection standards can be met when the appropriate safety practices are followed. For example, at the Bunker Hill Superfund Site, which was discussed above, personnel air monitoring of workers was conducted during the soil removals in both 1989 and 1990 (Ecology and Environment, 1990, 1991). Although the removals spanned a period of several months and many workers were involved, there were only a total of two daily violations of the lead criteria developed for protection of workers by the Occupational Safety and Health Administration (OSHA). Both violations occurred because safety practices that had been established for site clean-up were not being followed. (In one case a worker had operated a front-end leader in an area that had not been wetted down; in the other, a different worker performed hand excavation activities in an enclosed area that had not been wetted down). Results from other sites where soil removal has occurred, including the East Helena Superfund Site where Asarco is the responsible party and is conducting the soil removal, have shown that workers can be protected from both environmental contaminants and physical hazards when appropriate practices are implemented to protect workers.

In its comments on the FS, Asarco states that EPA should have quantified the short-term risks to workers that might result from transportation of contaminated soils off-site and compared this to the continuing risk of disease if soils are left in place. Part C states that "factors not associated directly with hazards particular to a given site (e.g., risk of accidents during off-site motor vehicle transport) are not usually considered during the FS, but instead should be addressed prior to remediation in the site health and safety plan."

Although Part C does not require an evaluation of risks from transport, the Ruston/North Tacoma FS (Bechtel, 1992b) does in fact include some qualitative discussion on the risks from transport and disposal of excavated materials. The summary comparative analysis of the remedial alternatives in the FS (Table 4-7) identifies an increased level of traffic and increased likelihood of vehicle accidents for those alternatives involving the removal of larger quantities of contaminated soils. The detailed evaluation of alternatives also identifies increased vehicle miles traveled and associated increased risks of accidents for several alternatives (for example, see page 4-32 for Alternative 5). These qualitative comparisons among alternatives can be considered by EPA in selecting a preferred alternative and in developing the Proposed Plan. The information included in the FS fulfills the requirements of the Part C guidance.

Attachments to Asarco's comments include preliminary attempts to quantify risks of accidents, injuries, or fatalities from the transport of excavated materials under the remedial alternatives (see Exhibits E and H of Asarco's comments). Those estimates are based on traffic risk parameters that are not specific to Washington state. The Washington State Department of Ecology, in its development of the Model Toxics Cleanup Act Cleanup Standards, performed an evaluation of possible traffic risks using Washington data (Ecology, 1990). The analysis was based on data for highway segments between the Puget Sound region and the Arlington, Oregon hazardous waste landfill, the same route of concern with respect to the Ruston/North Tacoma Operable Unit. The estimated fatality risks calculated using local data are less than one-half those in the Asarco exhibits (see Ecology, 1990, page 7-13). All of these transportation risk estimates are subject to substantial uncertainty. Factors such as the age and maintenance of vehicles, hiring and training of drivers, restricted operating hours, and restricted routes of operation, for example, may differentiate hazardous materials transporters from the general trucking industry and make the use of general truck accident statistics non-representative.

Any comparison of estimated transportation risks with the risks from chemical exposures under the No Action alternative (as presented in the Baseline Risk Assessment) needs to include more than a direct numerical comparison. Any transportation risks would be limited in duration, ending when the short-term transportation activities were completed. Without a significant reduction in soil arsenic and lead concentrations over time, the risks to the Ruston/North Tacoma population (current and future residents) would extend indefinitely into the future. The cumulative risks over time associated with chemical exposures would therefore exceed any traffic risks. As suggested in the Part C guidance, possible mitigation of transportation risks can be considered in the site health and safety plan developed as part of any remedial actions. The populations exposed to transportation risks and site-related chemical exposures are different, and they differ with respect to whether or not the risks experienced are voluntary or associated with other benefits. These other factors characterizing risks are important to consider in comparing risk estimates, as discussed elsewhere (see, for example, Ecology, 1990).

E. Feasibility Study Report

Asarco's Comment: The FS improperly fails to include enough detail for an alternative relying exclusively on institutional controls (Alternative 2), thus making it virtually impossible for a decisionmaker to consider such an alternative seriously.

EPA's Response: The description in the FS of institutional controls or community protection measures was intended to provide a broad range of potential legal or administrative measures that could be implemented in the absence of an engineering solution. EPA believed that it needed more public comment and discussion, including comments from agencies that may be called upon to enforce such requirements, before it could describe specifically a program of community protection measures that could serve as a remedial alternative.

Nevertheless, in the Proposed Plan, EPA and Ecology reaffirm their finding in the FS that an alternative that relies solely on institutional controls should not be selected because a cleanup alternative involving active measures (e.g., soil removal) is practicable. The Proposed Plan, however, does describe the specific objectives of a program for community protection measures that would be implemented in conjunction with soil removal under the Preferred Alternative (see section (H)(10)).

<u>Asarco's Comment</u>: *The time frames for Alternatives 3, 4, 5, and 6 are extremely lengthy (7 to 12 years) and do not comply with MTCA's requirements for a reasonable remedial remediation time frame. WAC 173-304-360(3)(b).*

<u>EPA's Response</u>: Neither the NCP nor MTCA (WAC § 173-340-360(6)) specify, by number of years, remedial action time frames that are either reasonable or unreasonable. EPA estimates that the Preferred Alternative will take 7 years to complete but requests public comment on whether the Study Area residents are willing to accept more trucks and work crews in order to shorten the remedial time frame (see section (F)(6) of the Proposed Plan).[2]

<u>Asarco's Comment</u>: *The FS does not provide the type of cost/benefit analysis required by both CERCLA and MTCA for use in remedy selection. The FS underestimates the already substantial*

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[2] In Exhibit H to its comment letter dated April 17, 1992, Asarco stated that EPA's assumption of a 10-month construction season was unreasonable -- and the estimated timeframes for completion of excavation alternatives were underestimated -- because remedial activities can only be conducted during a few months of the year. EPA responds that its FS consultant, Bechtel, Inc., believes that it is reasonable and practicable to expect that shallow excavation can be conducted in the Study Area for approximately 10 months out of the year based on its experience with construction projects in the Pacific Northwest. Bechtel noted that the remedial action would not involve any type of complex building or deep excavation requiring shoring that could be more susceptible to adverse weather conditions.

incremental costs of the excavation alternatives. Consequently, these alternatives should be re-evaluated and considered for elimination. The FS does not properly consider the factors listed in WAC 173-340-360 for selection of cleanup actions. The FS failed to analyze whether a cleanup action was practicable, i.e., whether the incremental cost of the cleanup action is substantial and disproportionate to the incremental degree of protection it would achieve over a lower preference cleanup action.

EPA's Response: NCP § 300.430(f)(1)(ii)((D) states that an alternative is cost-effective if its costs are proportional to its overall effectiveness. The preamble to the final NCP explains that the decisionmaker should compare, using best professional judgment, the relative magnitude of cost to effectiveness of each alternative. The decisionmaker should also examine incremental cost differences in relation to incremental differences in effectiveness. The decisionmaker is not expected, however, to apply strict mathematical proportionality in determining whether an alternative is cost-effective. 55 FR 8728 (March 8, 1990).

WAC § 173-340-360(5)(d)(vi) specifies a similar analysis. Under that section, a cleanup action is not practicable if the incremental cost is substantial and disproportionate to the incremental degree of protection it would achieve over a cleanup technology that is lower on MTCA's hierarchy of preferences, WAC § 173-340-360(4).

The FS provided estimates of the cost of each alternative, based on the estimated cost of the individual components comprising each alternative. Each estimate also included a 25 percent contingency because of the absence of an historical database of the actual costs for previous cleanups of similar residential areas. This contingency should address any components of an alternative that EPA may have underestimated. EPA believes that the estimates for each alternative, including the Preferred Alternative, are reasonable based on information currently available.[3]

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[3] Asarco also specifically commented that EPA had underestimated the cost of remedial alternatives because EPA had not taken into account "constructability" difficulties, e.g., problems associated with soil texture and limited access at the site (Exhibit H to Asarco's comment letter dated April 17, 1992). EPA responds that the assumption in its cost estimates is that 50 percent of the properties exceeding action levels would require manual excavation, which is more costly than excavation with

Those alternatives that involve soil removal are estimated to cost more to implement than alternatives that do not. EPA notes, however, that the estimated cost of the Preferred Alternative is less than the other alternatives involving soil removal except Alternative 4a. Alternative 4a estimates costs based on disposal at the smelter site. The decision to construct an on-site repository will be made as part of the smelter cleanup process.

The FS and the Proposed Plan also include lengthy discussions and comparisons of the long-term effectiveness of each alternative. EPA believes that the alternatives involving soil removal, including the Preferred Alternative, will be more effective and permanent over the long-term than alternatives that do not require extensive soil removal. Soil removal is much more certain to prevent or reduce exposure to contaminants over the long-term than providing a sod barrier (that may erode over the years) or rely on legal and voluntary measures (that may not be accepted or complied with in the future).

Based on its analysis of differences in cost and effectiveness, EPA has determined that the additional cost of soil removal is proportional to its effectiveness, i.e., the incremental cost of the alternatives that involve soil removal, including the Preferred Alternative, reasonably corresponds to the incremental difference in effectiveness among alternatives. EPA also notes that the estimated costs of the soil removal alternatives are substantially lower if it is assumed that the state's exemption to the dangerous waste regulations is approved.

Ecology has done a similar comparison of cost versus long-term effectiveness for the range of alternatives and has determined that the cost of the soil removal alternatives (Alternatives 4, 5, and the Preferred Alternative) is not substantial and disproportionate to the cost of the non-soil removal alternatives.

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backhoes or other large pieces of equipment. Accordingly, EPA believes that its cost estimate sufficiently takes into account property-specific difficulties that may be encountered.

Moreover, EPA notes that Asarco's evaluation of unit costs and quantities in section 3.1.2.3. of Exhibit H identifies significant items that Asarco believes EPA <u>overestimated</u> in the FS. Asarco does not reconcile its general comment that EPA's FS <u>under</u>estimated the cost of the excavation alternatives with its specific identification of items that it believes are <u>over</u>estimated.

<u>Asarco's Comment</u>: Table 4.2 in the FS should be clarified to reflect that there is no MTCA requirement which specifically dictates that engineering controls are required for soil concentrations greater than 230 ppm and lead concentrations greater than 500 ppm. MTCA does not identify particular levels at which engineering controls must be used.

<u>EPA's Response</u>: Under MTCA, a distinction is made between cleanup <u>levels</u> and cleanup <u>actions</u>. Generally, cleanup levels are protective between 10^{-5} to 10^{-6} (e.g., for arsenic, 14 to 1.4 ppm) but cleanup is not required beyond background (20 ppm). Cleanup actions are ranked in preference from treatment technologies to disposal in a landfill to containment to institutional controls and monitoring (and combinations thereof). The appropriate cleanup action(s) to attain a protective cleanup level is determined on a site-specific basis.

For the Ruston/North Tacoma Study Area, Ecology made a determination in reviewing EPA's Decision Memorandum and Proposed Plan that a remedy involving both soil removal activities at and above EPA's proposed action levels for arsenic and lead and general education programs represented the "best balance" of factors to be considered under MTCA (see section (I)(8)).

F. <u>Further Development of Remedial Alternatives</u>

<u>Asarco's Comment</u>: EPA should reconsider the six remedial alternatives presented in the FS. Specifically:

(1) Alternative 3 should reflect more realistic assumptions -- most residences already have a well-established sod cover, therefore, new sod covers would not be necessary in all cases. Further, the FS's assumption that 50 percent of the area has soil conditions too poor to support sod is incorrect. Actual conditions do not indicate widespread areas with poor soils.

(2) Long-term operation and maintenance costs for sod caps should be the responsibility of the property owners.

(3) Unpaved parking lots and alleys should be capped with gravel instead of asphalt and should be maintained by the local government.

(4) Alternative 4 should be reevaluated to provide for 6 inch soil removal in areas where arsenic and lead

exceed action levels at the surface. Areas with concentrations exceeding action levels at both the surface and at 6 inches would be excavated.

(5) Slag would not be removed except as incidental to soil removal.

(6) The 41 acre area where lead exceeds action levels but arsenic does not should not be excavated.

<u>EPA's Response</u>: In response to Asarco's comments, EPA provides the following information:

(1) <u>Sod covers</u>. Under Alternative 3, EPA believes that it would be necessary to replace existing sod covers because contaminants may be present in the sod. Further, the FS's description of Alternative 3 stated: "It was assumed that 50 percent of the surface area to be remediated by sodding would require the removal of approximately 2 inches of soil" (page 3-5). This assumption was made not because of a concern with poor soil quality but rather because EPA believes that it may be necessary to remove some soil in order to prepare the surface for sod placement and growth and also because soil removal may be necessary to maintain the original grade.

(2) <u>Maintenance costs</u>. EPA believes that long-term maintenance costs for soil or sod caps are response costs that are necessary to ensure the integrity and long-term effectiveness of the remedial action. Therefore, Asarco would be liable for these costs under CERCLA § 107 insofar as they are "not inconsistent with the National Contingency Plan."

(3) <u>Asphalt capping</u>. EPA believes that asphalt capping of unpaved lots and alleys is necessary to provide a relatively impermeable barrier to direct contact with slag residues and/or contaminated dirt present in the road base. A gravel cover could easily be penetrated and would not be as effective over the long-term as an asphalt cover in preventing disturbance of contaminated materials in lots and alleys. For the reason described in (2) above, EPA believes that Asarco should participate in the monitoring and maintenance of asphalt caps.

(4) <u>Excavation</u>. The Preferred Alternative will require excavation of properties exceeding action levels only to the depth where contamination is detected by sampling (to a maximum depth of 18 inches).

(5) <u>Slag</u>. The Preferred Alternative provides that slag driveways (and other forms of slag where small particles could

break off and be ingested or resuspended) that is present at properties that exceed action levels will be removed. Further, the Preferred Alternative states that slag will be removed at properties within the Study Area that do not exceed action levels unless new studies or information indicate that removal is not necessary to protect public health.

(6) Lead-only properties. EPA will require cleanup at properties that exceed only the action level for lead if there is a reasonable certainty that the elevated lead concentrations are the result of emissions from the smelter.

G. Conclusion

EPA believes that it has addressed the significant comments raised in your letter dated April 17, 1992. Please call me at 553-4951 if you have any questions about EPA's responses. We look forward to working with Asarco on the further development of the remedial action for the Ruston/North Tacoma Study Area.

Sincerely,

Piper L. Peterson
Remedial Project Manager

cc: Michael R. Thorp, HEWM
Linda Larson, HEWM
Bruce Cochran, Ecology

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